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Interactive Radio Instruction: Impact, Sustainability, and Future Directions

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Education Development Center



**INTERACTIVE RADIO INSTRUCTION:
IMPACT, SUSTAINABILITY, AND FUTURE DIRECTIONS**

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1999

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EDUCATION AND TECHNOLOGY TEAM**

**USAID'S ADVANCING BASIC EDUCATION AND LITERACY PROJECT
EDUCATION DEVELOPMENT CENTER**

ACRONYMS AND ABBREVIATIONS

ABEL	Advancing Basic Education and Literacy project (USAID)
AED	Academy for Educational Development
AJARI	Aprendamos Jugando Activamente con Radio Interactiva
AVANCE	Association for the Promotion and Socioeconomic Development of Honduras
BANFES	Basic and Non-Formal Education Systems Project (USAID)
CENADI	National Didactic Center of Costa Rica
CENAMEC	Centro Nacional para el Mejoramiento de la Enseñanza de la Ciencia
ECD	early childhood development
EDC	Education Development Center
EIA	English In Action
ESL	English as a second language
HDNED	Human Development Network—Education (The World Bank)
IMRC	Instructional Materials Resource Center
IRI	Interactive radio instruction
KIE	Kenya Institute of Education
LDTC	Lesotho Distance Teaching Center
LearnTech	Learning Technologies for Basic Education (USAID)
MOE	ministry of education
NCDC	National Curriculum Development Center
NGO	nongovernmental organization
NORAD	Norwegian Agency for International Development
OLSET	Open Learning Systems Education Trust (South Africa)
ONAMFA	National Organization for Minors, Women, and Family
PARI	Programa de Aprendizaje por Radio Interactiva
PARIB	Programa de Aprendizaje Interactivo por Radio en Bolivia
PEEP	Primary Education Efficiency Project (USAID)
PER	Programa de Educación por Radio
PIDI	Programa Integral de Desarrollo Infantil
PNG	Papua New Guinea
PVO	private voluntary organization
RLP	Radio Learning Project (USAID)
RADECO	Radio Assisted Community Basic Education Project (USAID)
SABC	South Africa Broadcasting Corporation
Unicef	United Nations Children’s Fund
USAID	United States Agency for International Development
USAID/Country	in-country USAID mission
USAID/S&T	USAID Bureau for Science and Technology

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FOREWORD

BY MICHAEL POTASHNIK AND STEPHEN ANZALONE

This study of Interactive Radio Instruction, or IRI, helps us appreciate the accessibility and effectiveness of radio as a tool for active learning inside and outside of the classroom. It synthesizes the knowledge and experience accumulated over the past twenty-five years in the use of radio for instruction in more than twenty developing countries. While IRI is the main focus of the study, as John Mayo points out in his introduction, it is by no means the only method for using radio successfully in education. However, IRI has been among the most widely used methods in the developing world, due in good measure to advocacy and funding by USAID. Indeed, virtually all of the IRI projects listed in this study have benefited from some form of USAID support, with other agencies playing comparatively minor roles.

Despite its successes, radio instruction, and IRI in particular, has clearly not received the attention it deserves. Indeed, if there is any one failure of IRI it has been the inability of its proponents to develop or sustain a sufficiently broad base of support among developing countries and other aid donors. This is a great pity. Our hope is that the examples provided here of where and how IRI has worked will spur the international community to reexamine radio's potential and the particular methods that make it function effectively as an instructional tool.

While IRI is in no sense a panacea for all of the problems facing education, it has certainly shown itself to be an effective tool to improve educational quality in the classroom at an affordable cost. There is no more cost-effective medium than radio for reaching learners inside and outside of classrooms in remote areas. While estimates vary from place to place, most indicate that

annual recurrent costs for radio instruction are in the range of \$2–3 per student.

Radio is clearly not a substitute for computers or the Internet. If schools or community learning centers can afford computers they should by all means acquire them. However, in much of the world, computers are not going to become available anytime soon—especially in more remote sites. Thus, radio continues to offer these school-aged students and adult learners the only real possibility of enrichment from the world outside. Moreover, recent advances in the development of low cost, windup radios and digital radio transmission to large populations promise to bring even more attractive and affordable options for using radio in remote sites in the coming years.

We believe this study provides a balanced account of the successes and failures of the international experience with IRI. Avoiding easy generalizations, it situates the unfolding of events in the richness of local context. We are not serving up simple verdicts or silver-bullet prescriptions. Rather, readers are reminded throughout of the need for a long range vision toward matters of implementation, ownership, and institutionalization during the length and breadth of complex processes of educational reform and innovation. With such considerations in mind, we hope that readers will find this study a useful addition to the literature on the development of education in developing countries.

We are indebted to the contributors to this study, who count among the world's leading authorities on radio instruction. Alan Dock, a senior education specialist currently working for the World Bank in Chad, is a Zimbabwe national. He designed radio programs for science education

while teaching in Zimbabwe, and later worked in Africa and Asia on distance education. John Helwig, a consultant living in Costa Rica, worked extensively for USAID in Latin America and for the World Bank in Central America. He is intimately knowledgeable of the use of radio in education, having provided technical support for many of the IRI projects in Latin America. John Mayo, dean of the College of Communication at Florida State University, has been for the past two decades one of the foremost international interlocutors in the area of communication for development. The other contributors, especially Andrea Bosch and Stuart Leigh, also have direct knowledge and experience with the use of radio in the classroom. Douglas L. Adkins, an economist and consultant to the World Bank's Education and Technology

Team, has done extensive analysis of the costs and affordability of education technology.

The World Bank's Education and Technology Team and USAID's ABEL 2 Project are pleased to have collaborated on this undertaking and look forward to receiving reactions from interested readers.

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1. RADIO'S ROLE IN EDUCATION AND DEVELOPMENT: INTRODUCTION AND OVERVIEW

BY JOHN MAYO

HISTORY OF DIFFERENT TYPES OF RADIO EDUCATION

Radio broadcasting, which began on a large scale in the 1920s, has proven to be a universally popular and adaptable form of mass communication. Across the globe, no other mass medium has attained comparable levels of audience saturation and acceptance. Even in technologically advanced societies where television has become people's primary source for news and entertainment, radio remains a vital source of information. It has retained such influence because of its credibility, portability, and relatively low production and distribution costs.

Although large nationally and internationally sponsored radio networks have existed for decades, radio remains a locally owned and operated institution in many societies. For this reason, community broadcasters are able to provide information and entertainment programs in listeners' mother tongues and in ways that meet the needs of illiterate individuals as well as those with little or no formal education. By the same token, radio is still an essential tool for promoting literacy and basic education at the grassroots level. In developing nations, both public and private agencies rely on radio to disseminate news about agricultural, nutritional, health, and family planning innovations. The costs of such activities compare favorably with other methods traditionally used to increase public awareness.

Numerous radio education strategies have been developed in recent decades to address citizens' demands for information, education, and entertainment. Such strategies have attempted, *inter alia*, to:

- disseminate information and advice necessary for people's survival and wellbeing (such as weather and crop conditions; and agricultural, health, nutritional, and family planning innovations; and radio forums in North America, South Asia, and West Africa);
- persuade people to adopt, alter, or discontinue specific behaviors (such as social marketing campaigns promoting the use of condoms as well as other means to contain the spread of HIV/AIDS and other sexually transmitted diseases in Caribbean, African, and Southeast Asian nations; and "info-tainment" and "edutainment" initiatives in the Philippines, Nigeria, and Mexico that incorporate family planning messages within hit songs, soap operas, and other popular radio formats);
- raise public consciousness and stimulate popular action in support of national, regional, and local development initiatives (such as social mobilization campaigns for literacy, family planning, and rural health in Cuba, China, and Tanzania; and community/religious radio stations throughout Latin America and the Philippines);



Kit Yasin

- expand access to education and training, both in and out of school (such as Australia's *Schools of the Air*; radio schools in Latin America; and teacher training at a distance in Tanzania, Zimbabwe, Nigeria, Nepal, Indonesia, Sri Lanka, and the Dominican Republic);
- enrich the quality of schooling by providing teachers and students with learning experiences and resources that are not available at the local level (such as school broadcasting services in England and many other Commonwealth nations); and
- raise student achievement in specific academic subjects via broadcast lessons linked to other pedagogical innovations, including restructured curricula, teacher guides, and student worksheets (such as interactive radio instruction, or IRI, projects in Nicaragua, Kenya, the Dominican Republic, Lesotho, Venezuela, South Africa, and other countries).

Although such strategies have used radio in many different ways to achieve many different objectives, the success of such endeavors over the years has produced a convergent set of lessons for the future. One lesson may be summarized in a simple but frequently ignored maxim, which is to "Know thy audience!" Effective radio programs, i.e., those that attract and affect listeners in prescribed ways, generally are based on extensive target audience research. With an awareness of a particular audience's knowledge, attitudes, behaviors, and listening habits, program designers can develop programs that convey information in comprehensible, compelling, and culturally appropriate ways. Of course, preproduction research can never resolve all the questions and uncertainties program planners may have concerning a target audience's likely interests and motivations. For this reason, pretesting of messages, monitoring of local reception patterns, and measurement of program impacts are activities that correlate with effective development broadcasting.

Successful programs provide information that audiences perceive to be of value to their daily

lives and circumstances. Depending on their aims, e.g., information dissemination, attitude change, or behavior change, program sponsors also may be required to provide supplementary incentives and resources, without which listeners may be unwilling or unable to act upon broadcast appeals alone. Experience suggests that listeners will become frustrated, cynical, and eventually inattentive if they are unable to obtain the resources needed to implement and sustain recommended changes at the local level. For this reason, radio must be considered as but one component of an effective development communication program.

For the reasons outlined above, multichannel communication systems have been favored over single channel ones in recent years. However, such systems tend to be more difficult and expensive to design, manage, and evaluate, especially when coordination among a variety of development sectors or media organizations is required. Management problems are compounded when, in addition to overseeing the design and delivery of messages, broadcasters try to link their programs to the demands and expectations of development workers in the field.

With respect to education, both in and out of school, radio has proven to be an effective development tool in a wide variety of settings. It has not been the panacea many of its early champions envisioned, however. In fact, throughout most of its history and in most of its applications, radio has been assigned only a secondary role in the classroom. Three distinct uses of radio for primary education are highlighted in the following sections.

Schools broadcasting

The British Broadcasting Service, or BBC, inaugurated its original schools broadcasting service in 1924. It provided only a few hours of programming per week and its use was dependent on the voluntary participation of school headmasters and teachers. The broadcasts complemented the work of local classroom teachers and were designed to introduce students to the world beyond their classrooms. This was accomplished through storytell-

ing, dramatizations, interviews, and other stimuli. Adaptations of this pioneering approach to radio education have been made throughout the British Commonwealth and in many other nations. Schools broadcasting is found in countries where television and other electronic media are not widely available. However, such services have never borne—nor have they been expected to bear—the major burden of instruction. By the same token, they have rarely, if ever, been closely associated with or held accountable for the achievement of specific learning objectives.

Radio schools

The goal of extending primary education to the isolated rural child and to small numbers of such children organized into listening groups was first achieved by another form of radio education begun in Australia in 1951. *Schools of the Air* initially could be considered a means of correspondence education or a form of home schooling augmented by regular radio contacts between distant teachers and students. Key to this model's success were careful planning and organization. Printed worksheets in support of radio lessons were considered essential, enabling children to see the words they heard on the radio and to review illustrations of concepts they were being presented. Typically, children completed written exercises during or immediately after each broadcast; then parents checked their work to ensure that adequate learning had occurred. In this way, vital feedback loops were maintained between students and teachers and between teachers and parents.

Adaptations of Australia's pioneering model of radio education have been tried in many nations over the past half-century. Radio, and more recently television, has appealed to policymakers concerned about the poor quality of primary and secondary schools. Lessons have been produced and transmitted with the intent of improving students' academic achievement; unfortunately, such efforts have not been successful in most cases. They have failed to achieve the benefits anticipated by their sponsors for a variety of reasons, including: (1) vague and unrealistic program ob-

jectives; (2) design flaws stemming from ignorance of the target audiences' (students and teachers) abilities and expectations; (3) reception difficulties due to faulty transmission and erratic power supplies; (4) scheduling conflicts; (5) receiver breakdowns and lack of repair facilities; (6) insufficient feedback; and, perhaps most significantly, (7) lack of support structures within schools or other community institutions to reinforce the broadcast lessons.

Interactive radio instruction

In 1974 Stanford University's Institute for Mathematical Studies in the Social Sciences, with financial support from the U.S. Agency for International Development (USAID), launched the *Radio Mathematics* project in Nicaragua. Members of the Stanford team and their counterparts in Nicaragua's Ministry of Education were determined to avoid the pedagogical and logistical problems that had undermined previous attempts to teach primary school mathematics by radio. The team adopted a robust curriculum development approach derived from programmed learning principles and techniques. The model incorporated extensive pretesting as well as other forms of formative evaluation.

Unlike other radio projects, Nicaragua's broadcast lessons were designed to provide most children's day-to-day math instruction. Interaction between students and the radio instructors was encouraged by providing time within the broadcast lessons for the children to make oral, written, and physical responses such as raising and clapping hands. Over time, the project's leaders allotted more time for such responses, sensing that they were instrumental in holding the young students' attention and reinforcing their learning.

Classroom teachers were responsible for preparing students to receive the radio lessons and for following up on lessons. Teachers received printed guides, which provided instructions and examples of how concepts presented in the radio lessons could be reinforced locally. As the project grew, so were the roles and responsibilities of

classroom teachers enlarged. Although the radio lessons had been designed originally to overcome the teachers' deficiencies, it was discovered early on that teacher enthusiasm for the project contributed significantly to student learning. For this reason, teachers were encouraged to intervene directly when students had difficulty comprehending the radio lessons.

Rapid and focused feedback was another innovation introduced by the *Radio Mathematics* project. Normally, instructional media projects rely on a lengthy develop–try out–revise strategy to validate new curricula. In fact, such a strategy was used initially in Nicaragua to help establish the radio lessons' basic content. Once daily broadcasting began, however, the project's researchers realized that they could not rely on such an approach to detect or correct weaknesses in their instructional system. It simply was too cumbersome and required too much time. Eventually, researchers developed rapid assessment procedures for obtaining student performance data. Such procedures were linked to a flexible production schedule, thereby permitting feedback from the field to be used much more quickly than it had been in the past. In this way, learning problems were detected early enough for midcourse corrections to be made in the course of a semester.

In February 1978, the *Radio Mathematics* project entered its fourth year. At that time, students enrolled in pilot classes (grades 1 through 4) were preparing to receive their math instruction by radio. The project was suspended, however, when political unrest intensified and school calendars were suspended for days or weeks at a time. Although radio math broadcasts never resumed following the end of hostilities, the project's initial success created a powerful legacy, so much so that in the intervening years a number of nations have imported Nicaragua's radio math lessons in toto for use in their own primary schools. Others have adapted the project's IRI model, including its innovative program development and evaluation techniques. Still others have expanded the original IRI model, using it to meet a variety

of needs, including adult education. The nature, success, and lessons learned from such experiences are discussed in the remainder of this report.

THE PURPOSE AND STRUCTURE OF THIS REPORT

IRI projects have been launched in more than twenty countries since the IRI methodology was first tested in Nicaragua in 1974. Fresh adaptations and applications of IRI continue to this day and can be found in Asia, Africa, and Latin America. Such efforts are being supported by national and international agencies, both public and private. At the same time, questions persist regarding why so many IRI initiatives have been short lived and, specifically, why so many have not survived the critical passage from pilot project to operating system.

In the chapters that follow, Alan Dock and John Helwig have assembled a series of essays that offer a provocative and encouraging review of IRI's promise and performance. Chapter 2, "An Overview of IRI Experience to Date," distinguishes IRI from other forms of radio education and distance learning and highlights the components of the model that have stood the test of time as well as the diverse learning objectives and conditions that have governed its use. Chapter 3, "Brief Case Studies of Six IRI Initiatives," presents brief studies of projects in the Dominican Republic, Lesotho, Bolivia, Honduras, South Africa, and Venezuela. The cases were chosen to present IRI's geographic diversity, flexibility, and the variety of socioeconomic conditions in which it has been tried. After presenting capsule histories, the authors discuss candidly the reasons for each project's endurance or decline over time. Chapter 4, "Effectiveness and Methodology of IRI," weighs the evidence from many studies that have examined IRI's performance vis-à-vis specific teaching and learning goals. The chapter also evaluates IRI's overall record in increasing educational opportunities for girls' access and isolated rural learners and improving the overall efficiency of educational systems.

Has IRI proven to be a cost-effective investment compared to other educational innovations? What have been its sources of support, both domestic and foreign? Are such sources sustainable? Is IRI an affordable investment within small as well as large systems? If so, under what conditions? The historical cost analysis presented in Chapter 5, "Cost and Finance," provides convincing answers to the above questions, along with insights concerning what are likely to be the sources of support for future projects and the best means for insuring adequate cost recovery.

Chapter 6, "Success and Sustainability," returns to the six case studies with an eye on both the past and the future of IRI. Addressing thorny issues pertaining to project sustainability and the impact of IRI in different countries, Chapter 6 suggests that maintenance of net benefits over time, rather than the survival or continued existence of particular projects, should be considered

the hallmark of success. Six internal and five external factors are identified that govern the sustainability of IRI programs. These factors, it is noted, have determined the fate of many other educational innovations and reforms as well.

Chapter 7, "A Paradigm Shift in the Delivery of Education," concludes by addressing a number of issues noted briefly in this introduction, e.g., radio's future role in development, the advantages of multichannel communication strategies, and the rationale for investing in research-based instructional materials. Also considered in this chapter are ways in which IRI's power and influence could be augmented in the future, including the creation of more generic learning materials, better orientation and training of teachers as well as local support staff, and the use of enhanced technologies, including satellites and windup or solar-powered radio receivers, to increase coverage and improve access among poor and isolated audiences.

2. AN OVERVIEW OF IRI EXPERIENCE TO DATE

BY ALAN DOCK AND JOHN HELWIG

WHAT IS IRI?

IRI, a methodology developed to turn a typically one-way technology into a tool for active learning inside and outside of the classroom, continues to be an attractive educational strategy in developing countries twenty-five years after it was first used. The original model for teaching mathematics through IRI was created in Nicaragua by a team from Stanford University in collaboration with Nicaraguan educators during the early 1970s. The team sought to combine the low cost and broad reach of the radio medium and a clear understanding of how people learn. Since that time, at least twenty countries around the world have developed IRI programs for a variety of subjects, audiences, and learning environments. Many of these programs have been sustained for ten years or more. The methodology has been expanded and adapted to different levels of math, science, health, English, Spanish, Portuguese, environmental educa-

tion, early childhood development, and adult basic education for learners of all ages. In each case, the series has been designed by local specialists specifically to capture the interest of the learner and to meet learning objectives in that country. Twenty-five years later, interest in IRI does not appear to be waning.¹

IRI may be described as interactive lessons in which an external teaching element, delivered by a distant teacher through the medium of radio or audiocassette, is carefully integrated with classroom activities carried out by the classroom teacher and learners. Within this structure, the distant teacher carries the main weight of the teaching, and directs learning activities (such as exercises, answers to questions, songs, and practical tasks) that take place during carefully timed pauses in the audio script. The classroom teacher's role is often to facilitate the lesson, give individual assistance to learners, and provide followup support after the audio component is finished. In some programs, such as those for language instruction, the classroom teacher's role is expanded to include periods of teaching.

WHAT MAKES IRI DIFFERENT FROM OTHER DISTANCE LEARNING PROGRAMS?

IRI is distinct from most other forms of distance education in that its primary goal has been to improve educational quality. Unlike many distance learning programs that are primarily designed to address access issues, IRI was first



Andrea Bosch

¹Bosch, 1997. "Interactive Radio Instruction: Twenty-Three Years of Improving Educational Quality." Education and Technology Technical Notes Series, Vol. 2, No. 1. The World Bank. Washington, D.C.

used as a classroom tool to counteract low levels of teacher training, poor achievement among learners, and limited resources. While IRI has demonstrated that it can be used to expand access and increase equity in both formal and nonformal educational settings (see Chapter 3), it retains an emphasis on quality improvement through a development strategy and methodology that require active learning, attention to pedagogy, and formative evaluation as an integral part of its design.

A second distinguishing feature of the IRI methodology is its requirement that learners react to question prompts and exercises through verbal and physical responses to radio characters. It also frequently includes group work and physical and intellectual activities while the program is on the air. For both the teacher and student, the lesson becomes an immediate, hands-on, and experiential guide. Short pauses are provided throughout the lessons—after questions and during exercises—to ensure that students have adequate time to think and respond. Interaction is also encouraged between teachers and learners as they work together to conduct short experiments, do activities, and solve problems using local resources and imaginative situations and stories.²

The pedagogy of IRI is more deliberate than active learning alone. IRI series guide participants through a progression of activities related to measurable learning objectives. Educational content is organized and distributed across lessons so that learning builds upon previous knowledge and new learners can more easily construct an understanding of the subject being taught. Activities and problems are first modeled by radio characters so that teachers and learners have an idea of the process they are undertaking and of the skills and support that may be required. All these elements are knit together through story lines, music, characterization, and other attributes available through the audio medium.

IRI programs are tailored specifically to particular audiences and situations. An important as-

pect of the design, therefore, is the reliance on audience research, participation, and formative evaluation to ensure that the lessons are engaging and relevant and that learners can achieve the educational objectives. Preparing an IRI series, program planners change the format, activities, and pauses in each program with each cycle of feedback and observation.

Instruction by radio is interactive when students actually interact with radio characters who “teach” subjects such as mathematics, science, or language. During a twenty-to-thirty minute broadcast, children may interact as many as one hundred times with the radio instructors. The radio lessons are divided into several segments, and in a daily lesson new material may be introduced in one segment, while previously introduced material may be reinforced through new exercises. Short stories, songs, physical exercises, and games are used, as well as regular interactive dialogue. Lessons are designed to be upbeat, challenging, and happy episodes for the student. The common elements of all IRI programs are systemic instructional design, rigorous formative evaluation, and a learner-centered orientation that aims to build delight in learning.

HOW IS AN IRI PROGRAM DEVELOPED?

Once a specific need for quality enhancement in a particular system has been identified, and the decision made to employ IRI, the program has two phases: the *development* phase and the *sustained implementation* phase. The development phase involves planning, scriptwriting, radio production, and piloting of the programs. Investment during this period requires financing a development staff of scriptwriters, radio technicians, actors, musicians, producers, trainers, evaluators, and management personnel; purchase or rental of radio production facilities; purchase of production supplies; purchase and distribution of radios to schools and tapes to radio stations; printing and distribution of trial materials; staff and teacher training; transportation and per diems for promoters, trainers, and evaluators; transmission time for radio broadcasts; and often, purchase of technical expertise.

²Bosch, op. cit., 1997.

Funds from development agencies such as USAID, United Nations agencies, or one of the development banks are often sought to cover most developmental costs. International assistance is usually extended for an initial period, during which the IRI program is developed, piloted, or tested, and becomes operational in a substantial number of classrooms. During this phase, the effectiveness of the program is tested, in terms of learning gains as well as teacher acceptance and support. Increasingly, the initiative for beginning an IRI project is being taken by the country itself, and external assistance, either technical or financial, may be sought only after development has started, e.g., the Venezuela project (see Chapter 3).

The sustained implementation phase depends on commitment from governments, donor agencies, teachers, and students. This commitment in turn depends on a number of policy and design factors that will be discussed in Chapter 6.

WHY USE IRI?

IRI can be used as an alternative instructional methodology when:

- subjects or topics are not taught by conventional methods (*use of media as the sole means of instruction*);
- subjects or topics are not currently taught well, or students require reinforcement or remedial instruction (*use of media to improve quality*);
- subjects or topics are studied by only a small number of students, and larger textbook development and teacher education programs cannot be justified (*use of media as a last resort*);
- there are not enough teachers for a subject or topic (*use of media to increase access*); or
- there is a need to reinforce direct instruction by providing practice to the student, or motivation to persevere, in a mix of media and conventional instruction (*use of media to enhance learning*).

The original *raison d'être* for IRI is contained in the above set of conditions, but over the years this perception has changed to the point where teachers recognize IRI as a valuable tool in itself, providing inputs that are both unique and effective in capturing and holding learner interest.

WHERE HAS IRI BEEN USED?

Table 2-1, which lists IRI projects that have been implemented or are being developed in over twenty countries, makes it obvious that USAID has been the main proponent of IRI since its first use in 1974. The agency began supporting the use of educational technology in the late 1960s, and has sponsored projects endeavoring to introduce educational television. In 1973, as the result of a congressional amendment to the Foreign Assistance Act directing the Agency to concentrate its efforts on the “poor majority” of the world’s least developed countries, USAID refocused its efforts on the lower cost alternative of radio and set about reinventing educational radio for the poorest children in the poorest nations of the world. In recent years, other donor agencies and lending institutions such as the World Bank have become interested in supporting IRI.

HOW SUSTAINABLE IS AN IRI PROGRAM?

As noted at the beginning of this chapter, IRI has been used in at least twenty countries over a period of twenty-five years. Most of these projects have been shown by careful evaluation to have achieved their goals. However, of the projects whose externally funded lives are over, only a few more than half are still fully operational. Research by a number of independent agencies over the years, some of which is summarized in Chapter 4, has clearly shown substantial learning gains for IRI beneficiaries across a wide range of designs and implementation climates. Each project has provided learner support that has significantly improved the quality of the teaching environment and the understanding of the student. If, in the majority of countries listed, the need for quality classroom support still exists, *why are only half of the programs still operational?*

Table 2-1: IRI programs that have been implemented or are in development

Country*	Principal funder	Year begun	Project title
Nicaragua	USAID	1974	Radio Math
Kenya	USAID	1980	Radio Language Arts (English)
Bolivia	USAID/Bolivia	1987	Radio Math
Bolivia	USAID/Bolivia	1992	Radio Health
Bolivia	USAID/Bolivia	1994	Early Childhood Development I: AJARI
Bolivia	USAID/PVO	1995	Early Childhood Development II: AJARI Bolivia
Bolivia	USAID/Bolivia	1997	Maternal Child Care
Lesotho	USAID/Lesotho	1987	Let's Learn English
Dominican Republic	USAID	1981	Radio Assisted Community Basic Education (RADECO)
Dominican Republic	USAID/DR COEDUCA	1993	Mental Arithmetic
Dominican Republic	World Bank	1993	Teacher Training
Dominican Republic	MOEs	1997	English in Action (each country developing its own version from common master plan)
Costa Rica	World Bank		
Costa Rica	USAID	1989	Mental Arithmetic: The Numbers Family
Costa Rica	USAID/Costa Rica	1991	Environmental Education
Honduras	USAID/Honduras	1987	Mental Arithmetic: The Numbers Family
Honduras	USAID/Honduras	1992	Adult Basic Education
Papua New Guinea	USAID/PNG	1986	IRI Science Education
Ecuador	USAID/Ecuador	1988	Radio Math Pilot
Ecuador	ABEL/Plan Int'l	1997	Early Childhood Education
South Africa	USAID/SA OLSET	1992	English in Action
South Africa	USAID/SA	1995	Early Childhood Education
Cape Verde	USAID/Unesco	1992	Radio Math (pilot testing in Mozambique, Angola, Guinea Bissau, Sao Tomé e Príncipe, and Cape Verde)
(PALOP countries)	UNDP/Dutch Govt.		
Haiti	USAID/Haiti	1995	IRI Civics, Creole, Math
	ABEL/USAID/Haiti		
Guatemala	USAID/Guatemala	1990	Radio Math and Radio Spanish
El Salvador	USAID/El Salvador	1992	Mental Arithmetic (adaptation of Honduras series)
	IADB	1996	Radio Spanish program to begin in 1998
Pakistan	USAID/Pakistan	1992	English in Action
	Asian Dev. Bank		Radio Math program to begin in 1999
Thailand	Thai Government	1980	Radio Math
Venezuela	Mendoza Found.	1991	Radio Math
	CENAMEC/Wld Bk		
Bangladesh	BRAC/Aga Khan F.	1994	English, Math (no information)
Indonesia Government	ADB	1993	Civics, Math, Teacher Training (no information)
Nepal	Unicef	1996	Early Childhood Education
Nepal	USAID/Nepal	1997	Rural Health Worker Training

***Note:** programs in countries in bold type are examined in Chapter 3.

The facts suggest that the success of an IRI program in the classroom and unambiguous learning gains do not of themselves assure sustainability. *One important aim of this book is to address the question by identifying some of the structural, management, financial, and political factors that govern the sustainability of educationally successful programs.*

To provide an informed basis for discussing the strengths, weaknesses, effectiveness, sustainability, and future applicability of IRI, Chapter 3 describes the development and implementation of six representative projects. The sampling of projects has been chosen with reference to the historical development of IRI, its geographical distribution, and the reasons for a project's success or failure.

The descriptions of the programs provoke questions about the role of aid agencies and governments in launching and sustaining an IRI project and about the systemic problems inherent in the development of any project. Partial answers are suggested in the discussion that follows. An analysis of effectiveness, costs, and factors controlling success and sustainability are the subject of later chapters.

This plan, the authors hope, will provide an adequate review of IRI for countries intending to introduce a project into their own education system. Planners can compare specific programs with their own countries' particular circumstances, move on to the more general analysis of IRI as a learning system, and then proceed with knowledge, confidence, and an awareness of the key issues that must be addressed to achieve long term success.

3. BRIEF CASE STUDIES OF SIX IRI INITIATIVES

BY JOHN HELWIG, ANDREA BOSCH, AND ALAN DOCK



Kit Yasin

DOMINICAN REPUBLIC: A SMALL EXPERIMENT THAT PLANNED FOR INSTITUTIONALIZATION

Following its 1974 Nicaragua and 1980 Kenya IRI programs, USAID decided to develop experimental nonformal IRI projects to determine whether they could provide low cost substitutes for traditional schooling. The projects were conceived as stopgap measures that would quickly provide schooling in places where there were either no schools or no trained teachers. In 1981, the Agency decided to expand this effort and, after conducting a survey in several poor nations, chose the southwestern region of the Dominican Republic to launch the *Radio Assisted Community Basic Education* (RADECO) program.

RADECO, the longest living IRI project, was initiated in 1981, went on the air in early 1983, and is still broadcasting to rural communities in the southwestern region of the Dominican Republic. The original RADECO programs were designed for a small and very specific population of approximately 8,000 students per year. The stu-

dents received nonformal short lessons in mathematics and Spanish that raised their test scores to approximately the same level as students in formal schools. Because the project has been sustained for almost seventeen years, the total population reached is now close to 140,000 (this figure does not include other IRI programs broadcast for math in the Dominican Republic). Much has already been written about this program, so the format and methodology of the lessons will not be described here in any great detail.

During the planning stage and the first years of the development phase, the USAID project office had very little formal contact with the Dominican Ministry of Education (MOE) central or regional office staffs, and went about identifying and organizing RADECO centers in communities without schools, recruiting local “radio auxiliaries” and supervisors, writing, producing, and eventually broadcasting and evaluating lessons on its own. During this period, the project was opposed by factions in the National Autonomous University, the teachers union, and the MOE. Much of this opposition was due to the project’s establishment in the city of Barahona, which is 200 kilometers from the capital city of Santo Domingo, and the feeling that MOE, union, and university leaders simply did not know what was going on. The project’s lack of coordination with national bodies was particularly significant. Another large IRI project in Kenya had failed due to a lack of consultation with the MOE on how to make the project’s and the MOE’s goals consistent. Without this dialogue, the MOE would not accept ownership of the project, nor responsibility for recurrent costs. To achieve an impact, it was important that the project in the Dominican Republic did not repeat these mistakes.

In 1983, a new project team began focusing on the project objective of institutionalization. A coordinating committee was formed, headed by the secretary of education, and including the MOE-appointed project director, the head of the MOE media division, the contractor's chief of party, and the local USAID Human Resource Division chief. In 1984, the technical division (scriptwriting and radio production units) was moved to the capital city, dramatically improving dialogue with the MOE and the chance of sustainability. The evaluation and supervision units remained in Barahona.

These and other long term efforts to coordinate with the government and other national groups led to a December 1985 international conference cosponsored by the MOE and RADECO, at which the secretary of education announced her complete support for the innovative educational program. By this time most of the dissenters had changed their minds and now supported RADECO. Shortly before the technical assistance team departed in late 1986, the MOE received approval for inclusion of a line item in its regular budget to cover RADECO's recurrent costs. The entire RADECO staff—scriptwriters, radio production personnel, field office staff, and radio auxiliaries—were paid through the regular MOE payroll starting in 1987. Transmission costs on local radio stations, rental of the field office, office expenses, vehicle maintenance, travel, and per diems were also paid for by the MOE. Finally, under the MOE line item, RADECO also negotiated an agreement with the government-owned national radio station for no-fee broadcasts.

In 1994, the government of Taiwan donated a radio transmission facility to the MOE. The facility was set up in Santo Domingo, and the present broadcast of *Radio ARED* (Educational Radio)—covers the greater metropolitan area, reaching about 45 percent of the country's population.

In spite of firm political support and the establishment of a sound financial footing, RADECO is now encountering new obstacles, among them the recent trend to adopt "constructivist learning," which is prompting

changes in the national curriculum. Official approval to prepare new national curriculum guides, testing materials, and textbooks is pending, but IRI methodology has been criticized as out of line with constructivist learning theory. It is also possible that the original need for the IRI programs has changed. Since RADECO began broadcasting in the southwest region, schools have been built and staffed in many of the communities it originally targeted and where RADECO centers continue to function. Today, many children attend regular school in the morning and RADECO centers in the afternoon.

To date, the MOE has not conducted a study to determine the relevance of the existing RADECO centers. Neither has there been an attempt to move RADECO operations to other regions of the country where there might be a greater need for the program. The MOE has a congressionally approved contract with Radio Barahona that guarantees broadcasts, and a budget line guaranteeing that RADECO centers may continue to operate. The RADECO supervisors and radio auxiliaries are on the MOE payroll. In summary, the program appears to have been institutionalized, has a well entrenched bureaucracy, but is operating under circumstances where its relevance is under debate. The question thus arises, when the objectives of a project have been achieved, should it change its focus to other regions or applications?

Lessons from the Dominican Republic

- IRI should be monitored and adapted to conform to prevailing education methodologies; the continued importance of the program should be assessed in the context of a gradually evolving system, in particular to sites where it is applied.
- Institutionalization of the program should be planned for during the development stage, including staff and broadcast costs.
- In some circumstances, IRI is an appropriate tool to cater to the needs of even a small specific population.

LESOTHO: SUSTAINING IRI FOR A DECADE THROUGH TAX LEVIES

All schooling after third grade in Lesotho is in English. Prior to the mid-1980s, many children did not continue past fourth grade, dropped out while struggling to complete the grade, or failed the grade because they had not learned enough English. In 1984, a group of Basotho educators from the MOE was invited by USAID/Lesotho to attend a conference celebrating the completion of the development phase of the Radio Language Arts project (RLA) in Kenya. They became convinced that their problems might be addressed through the RLA program.

Let's Learn English was developed in Lesotho between 1985 and 1991. USAID/Lesotho provided financing, and technical assistance was provided through USAID's Basic and Non-Formal Education Systems (BANFES) project. The program, adapted from Kenya's RLA project, consisted of 391 half-hour lessons broadcast to all the country's first through third grade classrooms, and has been on the air since 1987. The program was organized and managed by the Instructional Materials Resource Center (IMCR), and radio production was undertaken at the Lesotho Distance Teaching Center (LDTC). The IMCR has since been folded into the National Curriculum Development Center (NCDC), which presently has responsibility for *Let's Learn English*. An estimated 200,000 students listen to the program each year.

How has the Lesotho government sustained the use of the programs for over a decade when other countries have not? The program had the same basic requirements of others like it: recurrent costs, political and school-level allegiance, and flexibility. To cover recurrent costs, the government imposed a tax levy. To create allegiance, the programs were introduced as part of the national curriculum and are sustained by regular staff. In addition, the government-supported Radio Lesotho makes sure that the programs are broadcast daily. An efficient school supply unit ensures that radios and other material resources are all delivered on time to the classrooms. Thus, when *Let's Learn English* is on the air, students are in-

deed ready to learn. The program has survived because the country is small, the education system remains centralized, and educational politics have not changed.

Like the Dominican Republic's experience with RADECO, the IRI programs in Lesotho were created over ten years ago and were based on the original second-language experiment with IRI. While learning gains and improved English skills among students have been attributed to the programs, the question has arisen about whether the methodology and the system should be updated. A sustained program can, in fact, be a double-edged sword if it does not remain flexible enough to adapt with time. The original concept of IRI advocated a more rigid curriculum and a smaller role for the teacher than did programs created in the late 1980s and those envisioned for the 1990s. Interviews with teachers in Lesotho suggest that after eleven years some of them are becoming bored. Finding ways to keep the project alive through new types of training or applications could help sustain the project's effectiveness. *English in Action* in South Africa, a series that updated the pedagogy and dramatically increased the role of the teacher, is an option Lesotho might do well to consider.

Finally, there is the question of how to plan for flexibility and change down the road and who should be around the planning table. Classroom visits suggested that some teachers are not regularly using *Let's Learn English*, or are not sure how to use the program. Regular supervision, training, and retraining of classroom teachers appears not to be taking place, nor does there appear to be a strong advocacy group.

Lessons from Lesotho

- Planning for institutionalization may take different forms in different countries; strategies may be learned from other countries' examples.
- There may be problems with programs that are sustained for over ten years but are not kept up-to-date. For example, older IRI programs have not maintained the involvement of teachers.

- Planning recurrent costs to cover contact with teachers in the classroom is essential if continued commitment and evolution of the programs is to be achieved.

BOLIVIA: ESTABLISHMENT OF IRI MATH, HEALTH, AND EARLY CHILDHOOD DEVELOPMENT PROGRAMS

Three IRI programs have been developed and implemented in Bolivia since 1986, all with initial financing from USAID, and all implemented with the assistance of the Education Development Center (EDC). During the initial period, an IRI math program was developed for the second through fifth grades, through an agreement among USAID/Bolivia, USAID's Radio Learning Project (RLP), and *Fé y Alegria*, an education program initiated by the Jesuit order that administers several hundred schools under an agreement with the MOE. A pilot IRI preventive health program for the fourth and fifth grades was also developed in 1992 through this first agreement. Subsequently, USAID/Bolivia signed a direct agreement with the MOE to continue and expand both the radio math and preventive health programs. A semiautonomous agency, PARIB, was established to share management responsibilities with the MOE.

The *Aprendamos Jugando Activamente con Radio Interactiva* (AJARI) early childhood development IRI pilot program was developed in 1994 through the LearnTech project for the Integrated Early Childhood Development Program, an initiative of the National Organization for Minors, Women and Family (ONAMFA). Initial funding was provided through a World Bank loan, and was continued in 1995 through grants from USAID's Private Voluntary Office, Plan International, and Unicef. The AJARI pilot program aimed to develop and adapt the programs from Spanish into two indigenous languages, Aymara and Quechua.

Radio Math

In December 1985, two members of the Jesuit order working at *Fé y Alegria* in Bolivia attended a conference on IRI in the Dominican

Republic, where they saw in the IRI methodology a way to help Bolivian children increase their mastery of math and Bolivian teachers facilitate a more meaningful classroom experience for their students. The RLP was just underway, and its leaders were attending the conference. In the ensuing months, representatives from the RLP and *Fé y Alegria* met with USAID/Bolivia to develop plans for a Bolivian IRI math project.

The *Radio Math* program was developed between 1986 and 1991. The first levels were adapted from *Radio Math* in Nicaragua, while the rest of the program was developed completely in Bolivia. The program consists of 540 half-hour programs (135 for each level from second through fifth grades). In 1987, broadcasts began twice a day in two departments through a schedule coordinated with local schools. By 1993, *Radio Math* was on the air nationally in all nine departments; by 1996, the programs were reaching 185,000 students and teachers. In 1995, when the contract between USAID/Bolivia and LearnTech ended, USAID/Bolivia made funds available for a reduced local staff, limited supervision and training, and payment for radio broadcasts, reproduction, and distribution of materials. USAID/Bolivia funding ended in late 1997. A new government assumed office in August 1997, and the previous government, in its final months, was not prepared to search for funding to continue the program.

In 1995, the MOE began developing a new national curriculum under a reform program funded through a World Bank loan, and educational trends began to change in Bolivia. The education reform team considered the IRI math program inconsistent with the recently adopted constructivist learning theory. Perhaps, however, the new government was also reluctant to continue what had been initiated by a previous administration. While the reformers recognized that there was a great difference in learning gains between students who received the IRI lessons and those who did not, they were unwilling to support the program's continuation, and were unable to design a constructivist program or to revise the *Radio Math* program itself.

Box 3-1: Observations from field visits: Bolivia IRI mathematics

In several regions, radio transmissions have continued, mostly through church-owned stations providing free airtime, sponsorship by NGOs such as Plan International, or local government. In several classroom visits, we found that most teachers and children are enthusiastic supporters of the IRI programs. In one school not receiving IRI mathematics this year, we played lesson 39 for the fifth grade and noted the difficulty students had with the material. The teacher commented that the students were behind, and lamented the discontinuation of the IRI lessons. Studies have shown that IRI math students' learning gains are an average 20 percent above non-IRI students. A brochure published by PARIB contends that the learning gains of IRI math students are 40 percent higher than those obtained by students in non-IRI classrooms.

One teacher voiced the opinion that the *Radio Math* programs are repetitious, which seems a reasonable reaction for someone who has worked with the programs for over eight years. The Fé y Alegria Director for La Paz repeated this same observation, but agreed that the children seem to love the IRI classes, and most of them (with exception of some repeaters) listen to each lesson only once. Another teacher asked if *Radio Math* couldn't be broadcast less frequently, two or three times a week instead of daily, perhaps because *Radio Health* lessons are only broadcast once a week, and both teachers and students are able to maintain a high level of excitement. Preventing teacher boredom with the IRI system (perhaps with teaching in general) is a major concern of all.

After ten years, present indications are that textbooks will replace *Radio Math*. The issue of cost, i.e., using *Radio Math* (already developed and in place) versus writing or buying and printing new textbooks, financing their distribution, and training teachers in their use has not been evaluated against the known benefits of continuing the IRI system with modified materials.

Radio Health

As the math program was expanding throughout the country, the potential for timely and relevant health instruction also became apparent. Fifty percent of all girls leave school before reaching age 12, and research indicated that the messages learned in the formal classroom setting had a significant effect on girls' approach to motherhood. USAID agreed to support a small pilot program using IRI to develop an application to introduce health into the classroom.

The *IRI Preventive Health* program (PARI) consists of a total of ninety half-hour lessons distributed equally among third, fourth, and fifth

grades. At present the program is broadcast once a week to each grade level over thirteen radio stations nationally. The broadcasts reach approximately 125,000 students per year in 69 schools.

With the departure of the expatriate technical assistance team in 1996, PARI became part of the semiautonomous government group PARIB, which continues to implement the preventive health program. USAID/Bolivia funding was recently terminated, but Plan International, Save the Children, and other smaller nongovernmental organizations (NGOs) have picked up costs of airtime and implementation in some regions. However, the current commitment of counterpart funds from the MOE alone will not be enough to adequately sustain the program.

Aprendamos Jugando: IRI for early childhood development

In March 1993, the government and LearnTech agreed to experiment with ways of engaging young children in active play and simultaneously training caregivers through IRI

Box 3-2: Observations from field visit, Bolivia IRI health program

In two *Radio Health* classrooms in La Paz and Cochabamba, we witnessed a high degree of enthusiasm among children and teachers. The lessons required the teacher to write instructions and examples on the chalkboard as well as have liquids, towels, and other items ready for experiments to be performed by students during the broadcast period. Post-broadcast exercises included repetition (reinforcement) of the experiments. In both lessons the teachers and the children took the lessons very seriously and undertook all the exercises required. We also noted that PARIB supervisors regularly visited classrooms and are well known by the teachers and school principals.

methodology. The original premise for the programs was to meet the nonformal needs of illiterate caregivers to learn about early childhood development (ECD) through the audio medium. The government ECD programs showed a need for strategies for parental involvement and early education. Fifty programs were created in three languages along with many other materials such as a preliteracy *Big Book*, audio and print training modules, and radio spots. The first twenty programs were for 3 and 4 year old children; the second set of thirty programs was for 4-to-6 year old children. The series is based on competencies identified by the MOE educational reform team.

The AJARI series departed from previous models in several ways. First it was designed to reach two separate audiences—adult caregivers and children—and therefore was both a direct intervention for children and a training tool. The series also targeted a diverse, low-literate population nonformally and used a much more open-ended pedagogy that responded to the different goals of ECD as well as the call to conform to constructivist learning theories. Perhaps the most important difference in Bolivia, however, was AJARI's decision to utilize a decentralized implementation methodology. The AJARI series was still being created as the Bolivian government was undergoing decentralization; EDC and its partners decided to follow suit. The original LearnTech pilot programs, *Jugando en el Pidi*, were recreated to be usable in diverse environments; the series was renamed *Aprendamos Jugando*. Partnerships were created across formal and nonformal boundaries, and AJARI began to be marketed to local municipalities, health and edu-

cation programs, kindergarten programs, and indigenous social programs. Unicef and Plan International provided funds to adapt the programs culturally for two local language groups—Aymara and Quechua—and opened up new avenues for implementation. The training plan was decentralized and the series became attached to diverse systems working to support ECD.

The programs were still receiving USAID funding in 1997 and were being disseminated both on cassette and over local broadcast. Approximately 40,000 teachers, caregivers, and parents had been trained, and over 250,000 children reached directly (not including those who heard the programs on the air). The collaborating institutions provide trainers, supervisors, radio time, reproduction of cassettes, and batteries in some cases. The programs were perceived as different from the other Bolivian IRI programs, because they responded to current pedagogical trends and government policies. However, the implementation of a decentralized system was time consuming and labor intensive.

The ECD programs created an international ripple effect. Adaptations of the model have been begun in South Africa, Nepal, and Ecuador, and the Bolivian programs themselves are being used in Colombia and Ecuador.

Discussion of the three programs

In the eleven years since IRI was introduced in Bolivia, the MOE has not attempted to establish a budget line item to sustain the programs. The World Bank and IDB both finance large edu-

cational loan projects at present; however, neither of these loans includes financing for sustainability or expansion of the IRI programs.

While large learning gains can be attributed to the math IRI programs, and though they have been used by more than one million learners over ten years, it appears they will not survive the political and financial transitions taking place in Bolivia. There are at least three possible reasons for the demise of the programs: they failed to take the constructivist approach to learning; they were centrally operated projects in a decentralized world; and perhaps the new administration did not want to continue the programs of a past administration. Other than individual municipal decisions, no financial provisions have been made to keep *Radio Math* alive in 1998. Bolivia's experience leads to the question of whether ten years of impact, a million learners, and few signs of continuation should be considered a successful investment.

PARIB still supports the implementation of *Radio Health* and collaborates with a number of small funding agencies and the MOE, and a large number of third, fourth, and fifth graders and their teachers are tuning in each week. The question is whether implementation can be sustained when USAID funding ends. The AJARI program may have greatest potential for sustainability, since there has been a major effort to involve various partners. However, unless some organization or central entity becomes responsible for the program, it could easily fail in a short time. Many individual teachers, Fé y Alegria staff, some key MOE central and departmental directors, and several key university professors are vocally supportive of the IRI programs. However, there is no organized formal or informal autonomous group or association of strong IRI advocates in Bolivia. The only semi-organized advocacy comes from the NGOs and donor organizations associated with the AJARI program.

Lessons from Bolivia

- Overt high profile management of a program by an outside agency—whether donor or international NGO—does not build the internal

ownership and commitment required for long term financial sustainability.

- A gradual revision of lesson materials or the creation of supplementary systems or support to maintain relevance and match to educational theory could help avoid the disruption caused by political and pedagogical change.

HONDURAS: THE FIRST EXPERIMENT WITH PUBLIC-PRIVATE COLLABORATION

In 1986 USAID/Honduras, through the Primary Education Efficiency Project (PEEP), contracted the RLP to adapt or develop a primary math curriculum. The mission also wanted to initiate an innovative management and marketing approach for the IRI initiatives based on public-private sector agreements.

Although the math series was originally conceived as a second-generation adaptation of Nicaragua *Radio Math*, a major problem confronted the IRI team. The Nicaragua program was designed as a self-standing course in primary math, to be used without textbooks because of the difficulties of delivering texts and training remote teachers in their use. PEEP, through another intervention, was developing textbooks for Honduran primary schools and wanted to use the IRI programs to build educational relevancy. The IRI math program, therefore, had to be designed to support, rather than substitute for, the textbooks. It was as a result of this challenge that a new mental arithmetic series was created.

The cost of developing the new series, *La Familia de los Numeros* (The Numbers Family), was higher than the cost of adapting the Nicaraguan program, but less than any other original IRI series. Furthermore, new marketing strategies were used by which commercial enterprises financed the cost and distribution of copybooks for the students. A package containing a radio, teacher guide, and classroom posters was sold to teachers.

At that time, USAID was investing heavily in the development and nurturing of private volun-

tary organizations (PVOs) in many countries. In the early 1980s, USAID/Honduras financed the building of AVANCE (Association for Socioeconomic Advancement and Development), an institution founded by a group of loosely united businessmen and industrialists. AVANCE first developed a newspaper, *El Agricultor*, aimed at an audience of rural farm families. The newspaper was to be sold in rural areas with the idea that AVANCE would generate revenues to undertake new initiatives.

USAID/Honduras considered the MOE too poorly staffed and burdened by too many other activities to be able to fully manage the IRI program development. Furthermore, the funds available through PEEP were quite restricted. Thus, AVANCE was asked to provide space, administer the project, and generate funds to finance expansion and sustainability. AVANCE hired local technical staff, and the RLP provided staff training and guided the development process.

The Numbers Family consisted of 465 lessons that were broadcast daily to first through third-grade pupils. In 1989, the series reached approximately 180,000 children. A comparison was made between three groups of Honduran students, one that received traditional instruction, one that used the new textbooks, and another that used the radio lessons in addition to the textbooks. At the end of the first grade school year, the same test was given to all three groups. In the traditional group, 38 percent of the children passed, in the textbook group, 59 percent passed, and in the IRI and textbook group, 76 percent passed.

One of the most controversial aspects of the project was the marketing strategy AVANCE used to generate revenue. The materials—four large posters, a teacher’s guide, and a radio—were sold to teachers for US\$45. This strategy was based on market research conducted by AVANCE, which concluded that teachers preferred to keep control over the instructional materials by buying them themselves. In retrospect, it might have been better to have marketed the package to schools or parent-teacher organizations rather than to the teachers, who earned very low salaries.

Instead of proceeding to the development of the reading program, AVANCE decided to produce an English-as-a-second-language series. Scripts from Lesotho’s *Let’s Learn English* program were adapted and a 100-lesson series was produced and piloted in the North Coast and Bay Islands region of Honduras and in neighboring Belize. AVANCE was later able to market cassette lessons, scripts, and guides for the Belize MOE, financed through LearnTech.

Broadcast time was also paid for through the AVANCE/USAID system. This decision was perhaps what led to the project’s downfall. Differences concerning the future role of the MOE, AVANCE, and USAID/Honduras led to the eventual closure of *The Numbers Family*. The RLP’s involvement terminated in 1990, and soon after USAID/Honduras cut all support to AVANCE, but provided limited support to the MOE to enable program supervision and training activities to continue. AVANCE tried to sell the rights to the program—unsuccessfully—to the Honduran MOE. AVANCE was supposed to continue financing radio broadcast costs, but was unable to generate income and closed down the project. While teachers and students liked the programs and “owned” them, when the broadcasts were discontinued, the project died.

With funding from the RLP, Costa Rica purchased and adapted the series in 1989. By 1992, *The Numbers Family* had migrated to El Salvador, the Dominican Republic and, to some extent, Venezuela.

However, this was not the end of IRI in Honduras. The project’s evaluations were good, and the reasons that the IRI program had been shut down were clear. Having experimented with one methodology of public-private collaboration, USAID funded a different application of IRI in Honduras with a different public-private approach, this time for adult basic education. New partners were chosen and a local NGO, COEDUCA, began research and development of this six-level program through LearnTech. The project built upon other systems of adult educa-

tion and was planned to be implemented through community groups, NGOs, and private companies. The first three levels were largely based on IRI with some print support, and the last three levels were largely print with some IRI support. Individual financing differed slightly from one municipality to the next, but in all cases a facilitator or adult education teacher facilitated the use of the programs.

This nonformal application of IRI for adult education appears to be widely successful, and it was last estimated that 70,000 students were using the programs every year, with numbers rising as the last three levels were developed. Evaluations of learning gains show improvements in Spanish and math skills, with an increased impact and lower dropout rate for female participants. The public–NGO–private collaboration appears to work well, and essential recurrent costs are better anticipated.

Discussion

The way in which the public–private collaboration was envisioned in the original *Numbers Family* program did not work in Honduras. The idea of an MOE contracting for services is just beginning to take root in some developing countries, and the strategy was ahead of its time for Honduras. In Honduras in the mid-1980s, even the concept of a PVO was not widely understood, as there was no tradition of voluntary service in the country. Although USAID/Honduras viewed AVANCE as a service agency, it urged AVANCE to generate revenues to be able to sustain its two major initiatives, the newspaper, and the IRI program. As a result, there was major confusion regarding the objectives and mandate of AVANCE. The fledgling PVO was perceived by many Hondurans, even its own board members, as a commercial enterprise.

Although *The Numbers Family* and *English in Action* programs were discontinued, the IRI methodology continues to be highly regarded by the Honduran MOE, and the adult basic education series has been successful using a related and

equally innovative implementation approach. However, its long term sustainability is still not assured.

It might be said that *The Numbers Family* was technically successful, but the management and marketing approach was not sustainable. The program's impact upon education and future endeavors (such as its adaptation in other countries and new applications and experiments with public–private–NGO collaboration) make the experiences in Honduras useful for discussion of questions about impact and sustainability.

Lessons from Honduras

- Sophisticated organizational and financing strategies require careful assessment of local systems and preconceptions before introduction. The corollary to this is that specific orientation and training for all involved in the implementation of such strategies are essential.
- The use of public–private–NGO collaboration can be useful to implement IRI programs, but the collaboration must be compatible with the country's cultural and political culture.

SOUTH AFRICA: INCREASING THE ROLE OF THE TEACHER

In the early 1990s, when South Africa began the process of dismantling apartheid, it became increasingly clear that the importance of English language literacy would assume greater prominence in the anticipated democratic dispensation. A command of English could enable the young black, colored, and Indian South Africans to seek and obtain a considerably increased social mobility and more viable livelihood. Through the widespread use of English, the isolation or separation of the many alienated groups and the stigma felt by the previous dominant group could be lessened, and the creation of the new South Africa could be strengthened. The leaders of the struggle for a new educational order sought a way to reaffirm the dignity of African languages as well as cater to the need of the children of the marginalized commu-

nities throughout the country to learn English. USAID, through its support of South African NGOs, provided substantial information on projects that used the IRI methodology elsewhere as a means to language acquisition.

The Open Learning System Education Trust (OLSET) is an educational NGO headquartered in Johannesburg, which received funding from USAID/South Africa and the Norwegian Agency for International Development (NORAD) to develop an IRI *English in Action* (EIA) program, partially adapted from the original Kenyan programs. A pilot was developed and implemented in 1991 and 1992, with support from EDC and Real World Productions through the LearnTech project. By the end of 1998, three complete series of programs for first, second, and third grades of junior primary schooling had been fully developed.

OLSET is well organized, and has a local staff of highly competent English-as-a-second-language specialists, script and materials writers, radio producers, actors, supervisors, and trainers. The EIA program is of high quality and has enjoyed enthusiastic reception in schools located in historically disadvantaged areas of Kwa Zulu Natal, Free State, Eastern Cape, Northern, and Gauteng Provinces. In 1997, there were 2,154 classroom/teacher units, enabling just over 100,000 children to participate in the EIA program, more than double the numbers for 1996.

The South African EIA project pioneered some new approaches to IRI that departed from its original conception. For example, the teacher is given a much greater degree of freedom and responsibility than earlier second-language programs. The teacher leads the class and provides translation into the mother tongue throughout the programs. The series also depends heavily on a well developed regional training and institutionalization plan that allows teachers to be supported and print materials to be developed and distributed more easily.

Level 3 has now been completed, and OLSET will soon be offering the entire junior primary ESL

curriculum by radio. The South Africa Broadcasting Corporation (SABC) and the community radio stations, however, have already begun broadcasting some of the programs.

Discussion

Sustainability is very much in the mind of the OLSET team and its Board of Trustees. External funding, especially from USAID and NORAD will be available for a few more years, but in the long run, it will be necessary to obtain financial commitments from South Africa's provincial governments. This could be a difficult proposition—NGOs in South Africa have long been expected to finance the innovative programs the provincial MOEs ask them to implement. Moreover, as government budgets are stretched thin, it is difficult to predict how much longer OLSET will be able to continue paying all the costs without assistance from the MOEs, especially as demand for its programs continues to increase.

Even for the current program, costs may increase in the future as the “free” cost of broadcast time begins to be questioned. OLSET has managed to obtain free airtime through the government-owned SABC and provincial radio stations. However, several stations are already asking for programs to be shortened to suit their scheduling and formats, and there is also a movement to privatize some government-owned stations.

Field research has shown OLSET that teacher inservice as well as preservice training and supervision are vitally important. The human contact between OLSET, coordinators/trainers, and classroom teachers is crucial. In other IRI projects there is much emphasis placed on reducing the cost of training and supervision. In fact, James Cobbe, in his work on cost related to the EIA program, proposed *current* (as teacher training and supervision were being done in 1994), *intermediate*, and *minimal* models.¹ Indications gleaned from this and other projects suggest strongly that a minimal ap-

¹James Cobbe, *The Economics of Interactive Instruction: The Case of South Africa*, LearnTech Case Study No. 7, EDC and USAID, May 1995.

proach to teacher training will jeopardize the sustainability of the program.

In South Africa a potentially successful program is in the developmental stage. Teachers and school directors effectively support the program as well as the relationship with OLSET. The schools and teachers are enjoying the reception of all the basic IRI ingredients: radios, broadcasts, materials, and regular supervision and training. It is evident that the implementation team, under vigorous and charismatic leadership, has taken a great deal of care in the design of the program. However, for the program to be sustained and expanded, provincial MOEs must buy in—they must be willing to budget funds to insure sustainability and expansion in full recognition of the significant costs in training the teachers and funding air time.

Lessons from South Africa

- Programs that have originated relatively recently, like OLSET's EIA, can benefit enormously from the experiences of other countries, even in dramatically different contexts.
- Training and contact with the classroom teachers, far from being an optional extra, is vital to the life and sustainability of the program.
- It is important to identify early on hidden and “free” services (such as air time) that may be part of the initial startup support package, but must be incorporated into the financial plan in the long term.
- Program designers should take into account the scheduling and format needs of broadcasters. For example, OLSET has found that half-hour programs need to be shorter than thirty minutes to allow for news bulletins or other short announcements commonly heard at the beginning and end of half-hour slots.

VENEZUELA: LESSONS FROM SELF-STARTERS

A unique IRI program has developed over the

past six years in Venezuela—unique because it was almost entirely developed and implemented by Venezuelans themselves with funds from a World Bank loan; only thirteen days of development technical assistance was provided from outside sources.

The Venezuela MOE established the semiautonomous Center for Upgrading Science and Mathematics Education (CENAMEC) in the 1980s in response to national concern over low student performance in math and science. CENAMEC was partially funded by the Venezuelan government and by private institutions. In 1991, Luisa Mendoza de Pulido was simultaneously a member of the board of directors of CENAMEC, her own family foundation, and EDC. It was at EDC that she learned about IRI, and through resources provided by her family foundation, was able to encourage the formation of a CENEMAC team to develop an IRI pilot program.

EDC sent the deputy director of the LearnTech project and Altagracia Díaz de De Jesús, a specialist in IRI from the Dominican Republic, to brief CENEMAC staff members about IRI and assist them in developing a small pilot program. Later, a scriptwriter was sent to a scriptwriting training in Ohio. Funded by LearnTech, this training was the only external technical assistance provided to the program's development.

The CENAMEC team prepared a pilot program for second grade, adapting the Nicaragua *Radio Math* materials, and tested it in a few schools in poor neighborhoods of Caracas. The pilot was so successful that the MOE requested financing for a full-fledged program in a loan request to the World Bank. With the subsequent loan financing, CENAMEC has developed and implemented the *Matemática Divertida* (Math Is Fun) program. In mid-1997 the program consisted of 140 half-hour lessons for second grade and 135 lessons for third grade. The broadcasts reached 300,000 students in 12,000 classrooms in 15 of the 23 Venezuelan states. A pilot for first grade math lessons was successfully conducted during the 1996-97 school

year, and a 100-lesson series (three broadcasts per week) was broadcast along with second and third grade lessons, in the 1997/98 school year. During the 1996/97 school year the program was broadcast over the national radio station and seventeen regional stations. The program is broadcast twice daily, as most schools have double shifts. With the expected expansion to eighteen states and full implementation of the first grade program, *Math Is Fun* reached 600,000 students in the 1997/98 school year, making the Venezuelan program the largest current IRI project.

Participation in the *Math Is Fun* program is voluntary. Participating schools must register, and the school principal must participate in a five-hour training program. Prior to managing the IRI program, each classroom teacher receives ten hours of training, a lesson guide, and a kit of materials. Teachers are visited by supervisors/trainers at least once during the school year.

A national university research institute (IERU) and two private organizations (AFIN and CICE) have evaluated *Math Is Fun*. All three agreed that the IRI programs are very beneficial: IRI math students show significant learning gains compared to control group students, teachers' attitudes towards teaching math have changed positively, and teachers themselves now better understand the second and third grade math concepts. An indication of the perceived value of the program is that the CICE study showed major learning gains in rural schools, but inconclusive results in urban areas—where many control schools were clandestinely using the IRI program! Information obtained through classroom observations has again revealed the importance of teacher training and regular supervision. CENAMEC insists that initial training should focus on simulation exercises so that teachers fully understand their role before, during, and after IRI broadcasts. Researchers visited classrooms where students performed best and worst on AFIN tests and found that classes where teachers fully understood and managed the IRI methodology performed better than those who had not been well trained. CENAMEC plans to contract further evaluative studies.

Sustainability is a key issue being addressed by CENAMEC. While all development costs are financed through the World Bank loan, state governments are now financing some recurrent costs. At present, the state governments cover transportation and snacks for teacher training seminars. The states also cover salaries and office space for program supervisors. However, in 1997 the project has had to finance supervision travel since the state supervisors have had problems obtaining funding for these costs. States are willing to cover salaries but have not budgeted for travel expenses. CENAMEC is also encouraging states to pick up the costs of materials that have to be renewed annually, such as student workbooks.

In general, state governments have been expected to cover half the costs of radio broadcast expenses. However, in states where it is necessary to use more than one station to ensure full coverage, CENEMAC has found it necessary to put a ceiling on its contribution in an attempt to encourage states to cover the full costs of transmission. The current distribution of broadcast cost coverage is as follows: broadcast costs at seven stations are fully funded by six state governments; at six stations, state governments are covering 80 percent of the costs, with CENEMAC paying the remainder; at seven other stations the costs are split between states and CENEMAC; and in two stations, CENEMAC is fully supporting the broadcasting costs.

CENAMEC expects to expand coverage to all twenty-three Venezuelan states and to more than 60 percent of all schools under the current World Bank loan. This financing will cover the purchase and distribution of teacher guides, classroom kits, and radios, as well as the initial training sessions. Once these development costs have been covered, states must cover recurrent costs.

Discussion

One of the key reasons for the success of *Math Is Fun* is due to the high level of credibility of CENAMEC, and the competency, dedication, and enthusiasm of its IRI staff. The foundation was

given a great deal of autonomy to develop, test, and implement new curricular programs when it was founded, managing its own budget and hiring top-level specialists. CENEMAC's credibility has made it possible for the foundation to gain entrance to the offices of state governors and top officials, as well as to make the *Math Is Fun* program readily available to school officials, teachers, and parents. CENAMEC's IRI coordinators are nationally recognized educators, and the scriptwriters and radio production and training specialists are carefully selected from among the best young professionals and university graduates. A minor concern is that because CENAMEC is so well run and has such an excellent reputation, it is set apart from the regular MOE operation in the minds of users. This inevitably creates some pettiness that is expressed in slowness on procurement and other financial paperwork on the part of the MOE loan project office. While integration into the local structure is virtually total, even the small distance that exists between CENAMEC and the MOE as its parent organization is sufficient to raise warning signals.

Venezuela's decentralization process is on a fast track, which could help buffer the program from the possibility of derailment at the national level. In order to guarantee long term sustainability, it will be necessary to encourage state governments to provide funding for radio transmission as well as the establishment of staff for supervision and training in their own state MOEs. In the long run, it will probably be neces-

sary for CENAMEC to serve as a watchdog to ensure that states regularly cover all recurrent costs.

Lessons from Venezuela

- The relative autonomy of the implementing agency ensures its flexibility to respond to new demands.
- It is important to maintain credibility and a good working relationship with the MOE as the overall controlling agency.
- Nurturing political links through attention to image building and the provision of information that can be utilized as political currency helps ensure financial sustainability.

CONCLUSION

All six of these IRI initiatives had significant effects on the problems they were designed to address, especially in their early years. The Lesotho English, Dominican Republic RADECO, and Bolivia math programs are still on the air years after they were initiated. Indicators of success and sustainability can be found in all six initiatives reviewed, though each program's methods and achievements have differed dramatically. Implicit too in the success of these programs is the effectiveness of the IRI methodology they use. An analysis of this methodology, and the reasons for its effectiveness are discussed in Chapter 4.

4. EFFECTIVENESS AND METHODOLOGY OF IRI

BY STUART LEIGH AND FRANCIS P. CASH

EVIDENCE OF IRI'S EFFECTIVENESS

IRI has been intensively evaluated since its inception, both formatively and summatively—even as it has expanded beyond the first mathematics and language projects into new subject areas and adapted its designs to new audiences and developments in applied learning theory. A broad range of quantitative and qualitative evaluation techniques have been used, including test-based control and experimental group statistical studies, focus groups, interviews, and case studies.¹ There is a wealth of information on achievement and some information on other indicators. This evidence indicates that IRI programs elevate the quality of learning and teaching by enriching and upgrading curricula and materials. It also indicates that IRI projects help address other systemic objectives cost effectively by increasing access for rural and isolated learners, increasing equity, and improving the efficiency of educational systems.

IMPROVING EDUCATIONAL QUALITY

1. Primary school students' learning gains

IRI has helped improve educational quality in both remote and urban areas of countries such as Australia, Bolivia, the Dominican Republic, El Salvador, Honduras, Kenya, Lesotho, New Guinea, Nicaragua, South Africa, and Thailand. In Kenya, the first African country to attempt IRI



Andrea Bosch

for teaching English as a second language, students scored 18 percent higher on a standardized test than students in conventional classes.

The *English In Action* series in South Africa has taken IRI to junior primary schools in many disadvantaged communities. Findings from independent evaluations show that the greatest learning gain differentials (21 percent) were demonstrated in farm schools where infrastructural resources such as buildings, instructional materials, and skilled or even unskilled teachers were historically weakest.

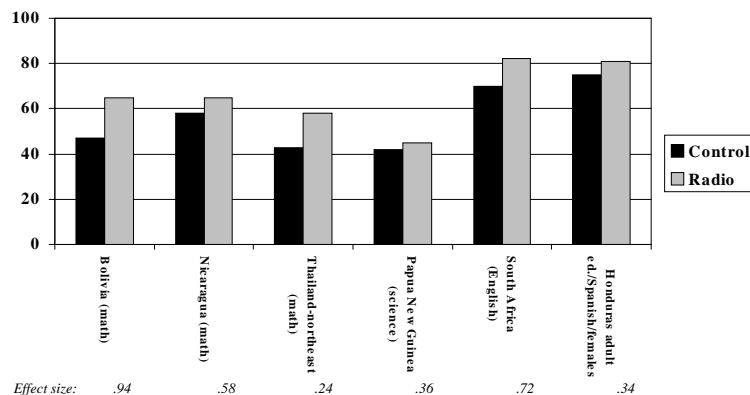
In a recent World Bank-funded review of experience with IRI, Bosch concludes that evaluations of IRI projects have repeatedly demonstrated elevated learning gains for IRI students when compared to students in control groups (Figure 4-1).²

Closer examination of some of these findings

¹The South African Radio Learning Project also used empowerment evaluation approaches (see the work of David Fetterman) to strengthen the project. Details in *English In Action in South Africa 1992–1994: A Formative Evaluation*, Charles Potter and Stuart Leigh, eds., LearnTech and OLSET, 1995.

²Andrea Bosch, *Interactive Radio Instruction: Twenty-Three Years of Improving Educational Quality*, (Education and Technology Notes, Volume 1 Number 1). World Bank, 1997, p. 3.

Figure 4-1: Studies of IRI—comparisons of mean post-test scores



Sources: Bosch (1997) from Tilson, Jamison, Fryer, Godoy-Kain, Imhoof, Christensen, and Roy (1991); Leigh (1995); Corrales (1995).

reveals even stronger evidence for learning gains attributable to IRI. Students have shown progressively greater increases in achievement over time. Leigh, for example, discovered that the improved performance of South African students correlates to the number of programs received. The achievement of students who received fewer than thirty-three *English In Action* lessons improved 7 percent; for those who received between thirty-four and sixty-six lessons, achievement improved by 13 percent; and for students who received more than sixty-six programs, achievement improved by 24 percent.³

Similar results were reported from Bolivia, where in 1991 evaluators reported that second graders using *Radio Math* scored significantly higher pass rates on standardized examinations (35 percent) than students in conventional classes (22.5 percent). The study also found that third grade students who had completed one year of radio lessons had average pass rates of 52 percent; those who had used IRI for two years scored 62 percent (the mean conventional score was 46 percent).⁴

³Stuart Leigh, *Changing Times in South Africa: Remodeling Interactive Learning*, LearnTech Case Study No. 8, EDC and USAID, July 1995, p. 28.

⁴Tilson, Jamison, Fryer, Godoy-Kain, Imhoof, *The Cost-Effectiveness of Interactive Radio Instruction for Improving Primary School Instruction in Honduras, Bolivia, and Lesotho*, EDC, March 1991.

2. Teachers' professional development

Recent case studies provide numerous indicators that IRI offers significant professional development possibilities for teachers. In Papua New Guinea, *Radio Science* teachers appreciate the opportunity to learn science along with their students because "it has been handled in a way that does not embarrass them in front of their colleagues."⁵ In South Africa, *English In Action* teachers are being offered many new strategies for effective language teaching and are finding a range of benefits. In a 1993 independent focus group evaluation study, Sbongile Nene wrote, "The program has been reported to build morale and confidence in both teachers and pupils."⁶ One OLSET teacher said:

I feel that my teaching styles have greatly improved. I have also acquired new methods of teaching English. My children are excited when it is time for the radio lesson. My vocabulary, listening skills, and communication have improved a lot. —N.F. Tsotetsi, Raemohetsoe School, Orange Farm, South Africa.

And another teacher said:

The way I teach has changed a lot. The methods I get from the radio I also apply them in other subjects that I teach. —Ngcobo, Mdumezulu Community Primary School, Umbumbulu, South Africa.

To maximize benefits for both students and teachers, the *English In Action* project developed a system of afternoon workshops called Teacher Support Group Meetings. These provide periodic opportunities for IRI teachers from a group of lo-

⁵Micael Olsson, *Institutionalizing Radio Science in New Guinea: A Response to Teacher Demand for Interactive Radio Instruction*, LearnTech Case Study No. 2, EDC and USAID, April 1994, p. 26.

⁶Sbongile Nene, *OLSET Focus Group Project*, OLSET, September 1993.

cal schools to meet on a peer-to-peer basis. Here, often joined by project staff, they discuss professional issues related to the effective use of IRI.⁷ One teacher in the group said:

You know, when you work in farm schools you get very isolated from people. The Teacher Support Group Meetings have from time to time brought me into contact with other teachers in my grades and I have found that there is so much information to share. The very idea of teachers from different schools coming together to discuss classroom practice is new with us. —M.M.C. Katsie, Joseph Ditsele Primary School.

Even without such support structures, IRI can influence teachers in many other positive ways. In an IRI lesson, the classroom teacher shares authority with the radio teacher who orchestrates the lesson. Both teachers guide and facilitate instruction, but neither dominates. By artfully modeling behaviors and attitudes for the classroom teacher, the radio characters offer teachers a means of discovering new ideas and teaching methods. For example, to help teachers apply constructivist learning theory, a model radio teacher can demonstrate enthusiasm for students' diverse solutions to the same mathematics problem. The radio teacher can also admit an error or lack of information in a broadcast and promise answers during the next broadcast. For example, if a radio science experiment does not work according to the plan, the radio instructor might say, "I wonder why. Let's test this a few more times off-air and get back with you during the next broadcast." Hearing such an "apology," the classroom teacher, who otherwise might be so intimidated by the prospect of emulating the radio teacher's skills (or of admitting that a lesson did not unfold entirely as planned), may be encouraged to continue working and learning from the program.

⁷While such multichannel systems as South Africa's *English In Action* are very effective, the additional costs of structures like teacher support groups must be considered. Useful analyses of the incremental costs of various levels of teacher support have been conducted, e.g., Cobbe. In some environments, the services of school inspectors and subject advisors can be enlisted to support such initiatives.

While IRI's influence on teachers is normally inservice, in some environments radio learning has entered the mainstream of preservice teacher education. In South Africa, OLSET's *English In Action* team has designed and conducted a preservice course called *Radio For Learning*, which is now being offered to student teachers by the Johannesburg College of Education.⁸ Such institutional alliances further demonstrate that IRI is accepted as an effective element of comprehensive educational renewal and reform strategies.

3. Adult learners

Primary school students and teachers are not IRI's only audience. In Honduras, adults enrolled in *Basic Education for All* radio classes and other adults in traditional adult evening classes were tested in mathematics and language (Spanish reading and writing). Radio students scored substantially higher than control students in mathematics. In Spanish, radio students again scored higher than control students, though by a smaller margin. While men in the radio group scored higher in mathematics than women, women began at a lower level and had higher learning gains than men. In Spanish, however, men began at a lower level and gained more. IRI thus can help narrow the gender gap in achievement between men and women. It is also significant that at all levels, *Basic Education for All* students showed lower attrition rates than did students in traditional classrooms.⁹ Increased retention and the closing of gender gaps are two indicators of the positive impact of IRI at the systemic level.

4. Very young learners

IRI summative evaluations of early childhood development programs in Bolivia and Nepal also show impressive results. In a Unicef study in Nepal, where the learning environment and caregiver knowledge were compared in pre- and

⁸*The South African Radio Learning Programme Newsletter*, OLSET, June 1997, pp. 4-5.

⁹Carleton Corrales, *Adult Basic Education In Honduras: Managing Multiple Channels*, LearnTech Case Study No. 9, EDC and USAID, April 1995, pp. 23-25.

post-testing, the environment and caregiver post mean scores were an average 45 percent higher in the experimental groups than in the control groups for both eastern and western regions.¹⁰

In Bolivia, a controlled study using the Abbreviated Child Development Scale (an evaluation tool created by Unicef/Colombia that includes indicators of physical growth, care, language, and cognition), found that IRI programs had an effect on overall child development—and not merely on education or cognition. Moreover, the results showed that the effect of IRI upon high risk children is greater than it is on other children. The use of IRI over four months decreased the number of children who fell into the high risk category by 7 percent.¹¹

SYSTEMIC EFFECTS

IRI is frequently regarded as a vehicle for improving the quality of educational inputs. However, perhaps IRI's greatest strength lies in its effects on systemic problems such as equity, access, internal efficiency, and cost effectiveness. There is considerable evidence showing that IRI can help address all these conditions.

1. Equity

One of the most common and intractable problems in some countries is the disparity between the performance levels of rural and urban students. Because IRI promotes greater standardization of quality via solid instructional design and broad low cost dissemination, it is well suited to help address such problems. In Bosch's review for the World Bank, the comparative effects of IRI on rural and urban children were detailed in Bolivia, Thailand, and South Africa (see Figure 4-2).¹²

IRI has also narrowed gender gaps. As in the

Honduran case cited above, girls' performance has matched or exceeded that of boys in Papua New Guinea's *Radio Science* and South Africa's *English In Action* programs.

2. Access

IRI has successfully brought educational opportunities to learners who might otherwise have had few or none. Since 1983, the Dominican Republic's RADECO project has helped isolated rural children with no access to formal schools achieve scores in mathematics and language tests that are equal to or greater than those of children in government schools. Similarly in Bangladesh, where girls are traditionally removed from formal schooling in their teens or earlier, the Bangladesh Rural Advancement Committee's (BRAC) large informal school system is producing IRI programs to teach English to children who would otherwise have no access to government schooling.

3. Internal efficiency

One indicator of an educational system's internal efficiency is the average number of years it takes for a learner to complete the education cycle. To make the system more efficient, education system planners need to be concerned about getting children to attend school, promoting them on time, and graduating them out. If IRI can help retain learners in schools, it will contribute to increased systemic efficiency. Honduras's *Basic Education for All* project showed that IRI can reduce attrition among adult learners. There are strong indications that IRI is doing this at the primary school level as well. For example, a South African independent evaluator, Sbongile Nene said, "In all regions teachers reported an improved class attendance on the part of pupils since the program began." Nene's observation has been corroborated by many specific reports. For example, the Mdumenzulu Community Primary School, situated in a rural area near Durban called Umbumbulu, suffered from a great deal of violence before the 1994 elections. The area has high unemployment and illiteracy rates, and the school does not have electricity or running water. Welcome Hiela, a

¹⁰*Interactive Radio Instruction for Early Childhood Development Programme: Summative Evaluation Report for the Pilot Phase*, UNICEF/Nepal, February 1998.

¹¹Tania Suvo, *Formative and Summative Evaluation of the IRI Package*, *Aprendamos Jugando*, USAID, 1997.

¹²Bosch, op. cit., p. 4.

teacher for 20 years and the school's principal, reports:

I have found the Radio Learning Project an essential teaching and learning aid. It has helped stimulate pupils' interest towards school. Our pupils, who have hated English because it is a foreign language, have now developed the love for the subject.... Because of English In Action, the number of absentees has dropped.

At Giyani Primary School near Johannesburg, M. Hlangwane, a teacher, noted the same trend:

The effects are [that] children no [longer] absent themselves from school and children are so grateful to be speaking such perfect English in their day-to-day life. Their listening skills are well developed.

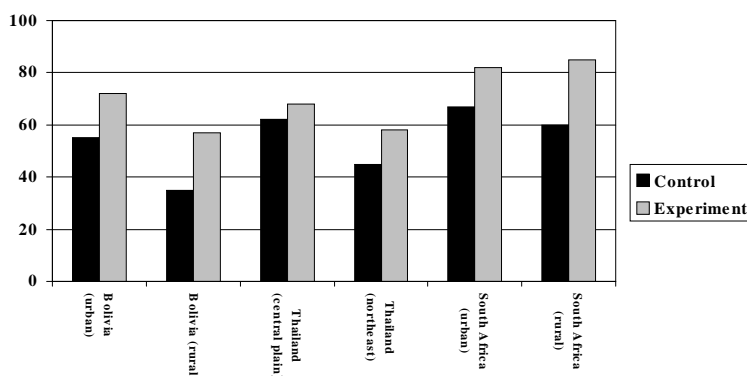
M.R. Maroga, a teacher at Kutung Primary school in Soshunguve, South Africa, concurs:

One of the things that the project has done is to improve attendance: most children simply love the radio lesson.

The implication of these and similar observations is that IRI pupils are more motivated to come to school and that attendance is more consistent. Studies show that when children come to school and participate in IRI programs, they consistently perform at higher levels than their peers in conventional classes. They are thus more likely to succeed in their course work and move more smoothly through the educational system.

While detailed comparative studies of the number of years to graduation of IRI students and non-IRI groups have not been made, one may, nevertheless, estimate these figures by extrapolation from common performance figures. IRI students tend to score about .5 standard deviation (SD) above comparison groups in IRI-taught subjects. Where typical learning gains for one year of

Figure 4-2: Urban-rural differentials



Sources: Bosch (1997) from Tilson, Jamison, Fryer, Godoy-Kain, Inmoof, Christensen, and Roy (1991); Leigh (1995); Corralles (1995).

conventional study are on the order of 1.0 SD, IRI learners (at 1.5 SD) may accomplish in two years what it takes learners in conventional classes three years to accomplish (3.0 SD).¹³

Finally, it is well known that competence in a widely spoken international language such as English, Spanish, or French can be critical to students' remaining in school and achieving academic success. As IRI has been utilized very effectively for foreign language instruction, it may offer an excellent means of increasing student retention and assisting their long term academic achievement.

4. Cost effectiveness

IRI projects can follow a number of paths; thus their costs may vary widely. For example, in market-oriented environments where there is more competitive pressure from commercial publishers, some projects can produce their print materials with four-color illustrations. Where there are concerns to optimize teacher development, projects have instituted modular systems of professional support. The various possible levels of such support for teachers in such projects have varying costs at different implementation scales.

While actual costs vary, cost effectiveness studies comparing various types of interventions

¹³From their statistical studies in Bolivia, Tilson, et al., op. cit., 1991, conclude that "by adding the radio lessons the children learn about a *half-year more* as compared to children in conventional classes."

(IRI vs. textbooks vs. IRI and textbooks together) to effect-size measurements have revealed that IRI is a comparatively affordable solution.¹⁴ In fact, IRI can be much less expensive than other options while producing greater effect sizes. Moreover, when IRI projects go to scale, the economic advantages can be substantial. With large audiences it costs little to add another radio student. (Chapter 5 takes a closer look at issues of finance.)

IRI AS AN EVOLVING METHODOLOGY

Each instructional technology offers learners certain types of interactions. Particular technologies can be located along a continuum of adaptiveness (sensitive interactivity). Ideally, a human teacher is fully adaptive to learners' responses. One-way taped radio broadcasts only simulate sensitive reactions to students' responses, and so are less adaptive and less interactive than advanced computer software. Yet IRI has achieved significant results despite its restricted interactivity.

In spite of its limitations as an interactive instructional technology, recorded audio (distributed by broadcast or audio cassette) clearly has strengths. For example, it offers standardized instruction at a high level of quality; it can heighten student motivation and interest by using sound, music, and drama to make learning more enjoyable and more relevant; it offers a media-enriched learning environment without determining learners' visual options (as video and computers typically do), and thus promotes imaginative visualization and allows easy and equal access for all students in large classes; and because radio has a relatively low per-student cost and its reach is so extensive, it offers the broadest service potential of all electronic technologies. (Where there are small audiences or remote groups beyond the reach of radio signals, the same IRI programs on audio cassettes have proven equally effective.) With such advantages, especially in developing countries, radio and audio continue to invite inventive instructional design.

Substantial innovations in instructional technologies and major developments in applied learning theory have occurred in recent years, and IRI projects have significantly evolved to reflect these changes, demonstrating that it is a dynamic and adaptable instructional methodology. Before outlining these developments, however, there are two constants to note.

1. Careful instructional design and evaluation: Most IRI projects demonstrate a commitment to careful instructional design. The sequencing of instructional units is carefully managed, and results are tracked through *formative evaluation*. In addition, most IRI projects have staff observe radio lessons in the field within weeks of their production. Teachers are also invited to offer suggestions for revisions. Students may be tested on discrete learning objectives that have been recently taught, and test results assist program designers to assess the effectiveness of specific sets of programs. In this way, weaknesses in design may be caught early and timely changes made.

2. Active learning: All accepted learning theories support the principle of *active learning*. While memorization is important for some skills, the importance of learning by doing cannot be over-emphasized. The IRI learner is frequently asked to do something in addition to listening, ranging from short vocal or physical responses to cues from the radio, guided manipulation of concrete materials, participatory songs, short group or pair activities (suggested by the radio and interpreted and facilitated by the classroom teacher), to followup activities to be completed after the radio lesson is over. Over time, the word *interactivity* has been applied in various ways to characterize IRI's commitment to active learning. IRI design teams are constantly seeking new ways to push back the limitations of one-way radio transmission.

Designing for multiple learning channels

An effective instructional radio methodology depends on establishing meaningful roles for a range of media and learning channels, such as the teacher, other peer learners, the community, the

¹⁴Tilson, et al., op. cit., 1991.

radio program, programs on audio cassettes, print, video, etc. While not all need be employed in every intervention, where designers can predict or determine the learning environment, it is useful to employ a number of available channels. A multichannel approach capitalizes on existing resources, expands the range of learner interactions, appeals to a number of senses, and promotes more powerful and relevant learning experiences.¹⁵

IRI projects begin through the creation of working teams of managers, curriculum and course designers, scriptwriters, producers, teacher trainers, and learner/school support staff. The team's goal may be to adapt, enrich, or upgrade an existing curriculum or course, or the team may wish to develop an entirely new curriculum or course. At the outset, the managers and curriculum/course designers set objectives and work with the writers and producers to determine which integrated media methodology to use. Learning objectives and instructional functions are mapped to one or more learning channel such as print (teacher guides, student workbooks, illustrated readers, posters), audio (radio or cassette), video (broadcast or tape), and field staff (for formative evaluation, teacher training, and support). In all cases, IRI projects are creative enterprises that must respond to unique local demands and opportunities while incorporating appropriate and up-to-date instructional methods.

Adapting to new currents in education

Since IRI's 1974 inception, there have been important developments in learning theory. Successive IRI designs have reflected these changes. Initially, design focused on such principles as distributive learning, by which students practice skills in short lesson segments distributed over days or weeks. Early programs also emphasized immediate reinforcement of correct responses. Cognitive and constructivist theories have now superseded behaviorist and associationist ones. These newer

learning theories emphasize the different ways individuals learn as well as the importance of the personal experience each learner brings to the educational setting. Recognizing that there are often multiple correct answers and ways of solving problems, constructivist approaches promote the use of instructional activities that are flexible enough to accommodate individual differences.

These developments have required adjustments in radio instructional design. For example, key to the success of Papua New Guinea's *Radio Science* is support for inquiry. Course designers determined that the fast-paced responses of earlier interactive radio lessons would be inappropriate and that "the more reflective, open ended questioning techniques used in adapting IRI for science are critical to the subject matter."¹⁶ Costa Rica's radio dramas for environmental education, *Let's Listen to the Earth*, also employ "open questions to stimulate thinking."¹⁷ Similarly, South Africa's *English In Action* and *My Maths: Many Times* promote activity-based learning and open-ended responses. Teachers are guided to create activities employing concrete materials from the immediate environment, or to seek ideas and unpredictable language from the children themselves. This makes the lessons more effective and relevant.¹⁸ Of course, teachers may need assistance to integrate such techniques into their teaching practice. Consequently, the professional development of teachers has become an essential linked objective of IRI projects.

Teacher development and programs for multiple audiences

While the first IRI programs were designed to meet the educational needs of the single audience of primary school children, in recent years a number of designs now have explicit objectives

¹⁵Stuart Leigh, Gordon Naidoo, and Lebo Rarnofoko, "South Africa: Designing Options for Educational Renewal," in *Multichannel Learning: Connecting All to Education*, EDC and USAID, 1995, pp. 119-32.

¹⁶Olsson, op. cit., p. 20.

¹⁷German Vargas, *Econauts: Mission Nature—Radio Drama For Environmental Education In Costa Rica*, LearnTech Case Study No. 5, February 1995, p.16.

¹⁸Leigh, *Changing Times In South Africa: Remodeling Interactive Learning*, LearnTech Case Study No. 8, EDC and USAID, June 1995.

for dual audiences. Programs address children while using the daily radio contact time with classroom teachers for a subtle form of inservice training. For example, IRI programs in South Africa now assist teachers of English as a second language to adopt learner-centered, activity-based language teaching methods. Similarly, early childhood development programs in Bolivia and South Africa simultaneously address learning objectives for very young children and their caregivers. These programs are designed to bridge the gap between theory and practice, providing caregivers “the opportunity to connect games and activities with early childhood development theory.”¹⁹ By raising the quality of instruction for children while assisting teachers to become competent with a range of effective activities (that they may use at any time with or without a radio or audio cassette program), IRI is helping educational systems to meet important objectives related to both pupils’ and teachers’ knowledge and skills.

This trend in IRI design is paying great dividends to teachers and their pupils, and teacher educators are taking notice. They know it is very difficult to find strategies to provide effective inservice training to teachers, especially to remote rural teachers. Without extrinsic motivators such as course accreditation leading to salary increases, virtually the only time that one can be certain of engaging teachers is while they are at work. However, while listening to a radio program each day with their students, teachers can be offered ideas for many effective instructional activities. In South Africa, after a year of exposure to hundreds of such ideas (via audio and integrated text in *English In Action*), many teachers have demonstrated a substantially broadened and updated repertoire of skills, and have come to see themselves as more inventive, capable, and reflective professionals.²⁰ In such projects, IRI promotes the development of effective teachers while assuring a quality learning experience for their pupils.

¹⁹Bosch, Andrea, *Jugando en el PIDI: Active Learning, Early Child Development and Interactive Radio Instruction—Supporting Caregivers, Parents, and Young Children*, LearnTech Case Study No. 4, EDC and USAID, January 1995, p. 35.

²⁰Leigh, op. cit., pp. 17-20.

How long should an IRI project run?

The productive life span of an IRI project is not easy to determine. An IRI intervention may be called for when decisionmakers determine that teachers are not fully competent in a given subject or when they think that children require a higher quality learning environment. The efficacy of the intervention is substantiated through testing, which may show that children learning through IRI score higher on tests than children in traditional classrooms. Studies may also show that IRI positively effects promotion, attendance, drop-out, and repetition rates. It is more difficult however, to show teacher learning gains as a result of “facilitating” the IRI lessons. There are anecdotal reports about teachers becoming more *participative*, i.e., using interactive techniques in regular non-IRI led subjects, but there are no definitive studies on changes in teachers’ understanding of mathematics, science, or language, or how to teach these subjects to young children as a consequence of an IRI intervention. If quality improvement is the justification to use IRI, then perhaps the productive life of the intervention would end when education systems are able to produce similar or better indications of learning gains at the same or lower cost per student. But if the intervention was responding to systemic problems such as equity or access, then cost considerations may mitigate against the program’s discontinuation.

One alternative to an IRI intervention would be through the implementation of a “reformed” or “transformed” strong, systematic preservice teacher training program. This program would graduate new teachers in sufficient numbers who fully understand the targeted subject concepts and possess the skills to teach them effectively. The development of this reformed teaching force, however, would require several years, and many learners would meanwhile miss out on the opportunity to receive a high quality education.

A second strategy would be to put in place a solid, systematic inservice teacher development program that can guarantee the same quality results as the preservice strategy described above.

This would entail a major investment that must be weighed against the cost of developing and sustaining an IRI intervention.

A third substitute for IRI would be the provision of high quality textbooks. However, it can also be argued that if teachers do not understand the concepts being presented, textbooks will not bring about good classroom teaching. Furthermore, studies have shown that textbooks are more costly than IRI.

Finally, policymakers may be tempted to invest in the latest techniques employing television and computers to upgrade their education systems. Leaving aside the questions of costs and maintenance as well as establishing equitable access to these much more complex systems, anyone who has observed students in an IRI lesson grappling with unfamiliar concepts soon realizes that the

process of concept building and internalization that takes place at each planned step in an IRI sequence is a powerful learning tool that loses nothing from its lack of visual representation.

CONCLUSION

Since 1974, IRI systems have adapted to a succession of educational environments, learning objectives, and audiences. As the designs of these systems have changed to keep pace with changes in instructional practice, IRI projects have continued to prove effective, even as newer and more fully interactive technologies have come into wider use. IRI remains on the educators' agenda because teachers and students continue to find satisfaction and value in its use, and because evaluations consistently show it to produce higher levels of learning—and at a lower cost—than the conventional systems IRI projects replace or augment.

5. COST AND FINANCE

BY DOUGLAS L. ADKINS

INTRODUCTION

The educational effectiveness of IRI has been demonstrated in previous chapters. This chapter attempts to assess the available evidence on whether this educational effectiveness is worth its cost, compared to other ways of enhancing educational quality. The chapter will examine the cost of IRI programs, sources of funding, and problems associated with ensuring a project's financial sustainability.

1. What does IRI cost?

For developing countries, many kinds of educational technology investments and their recurrent costs appear beyond the possibility of financing. This is especially true in countries that provide relatively small budget allocations for non-personnel costs. This chapter measures the budget effort needed for IRI programs by relating their costs to markers such as per-capita GDP,

public primary education expenditures, and expenditures on teaching materials.

2. How is IRI funded?

Even conventional public educational programs are often financed in part from funds outside the national budget. Because of IRI's nature, which involves the production, transmission, and reception of radio programs, there are greater opportunities to gain access to resources through government budget channels in non-education ministries, public production and broadcasting organizations, and international donors and also from private sources such as parents and communities. This chapter looks at the experience of countries in mobilizing financing from both the ministry of education (MOE) and other sources.

3. How can IRI become financially sustainable?

Financial sustainability is often a key problem for any innovative educational program. This chapter examines the special problems of countries in financially sustaining IRI and discusses the main lessons learned.

COSTS OF IRI

The major costs typically incurred by an IRI program are well known: investment costs for program development and startup and annual recurrent costs for air time, radios, production and distribution of cassettes and print materials, training of teachers and teacher trainers, continuing program development, insurance, maintenance, and administration. The



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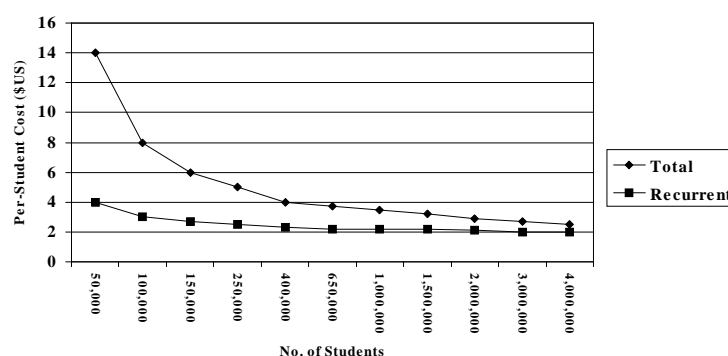
purpose of this discussion is not to forecast what the costs will be in any given circumstance, but to indicate the likely magnitude of the total cost of an IRI program and its major components, and to develop per-student costs for various scales of operation. For this purpose, we have constructed a cost model based on the experiences of several countries that have used IRI. Country cost data have been merged, updated, and adjusted for general applicability.

Scale economies

Before addressing individual cost items of IRI using this cost model, it is important to examine the question of scale economies. Chart 5-1 shows that scale economies are substantial when total costs are considered. To serve 1 million students, the cost per student is only 40 percent of what it costs to serve 100 thousand students. To serve 4 million students, the cost per student continues to decline, although not as quickly. The scale economies are clearly mainly in investment costs. Although there are some scale economies in recurrent costs, per-student recurrent cost for 1 million students is only 22 percent less than for 100 thousand students. And to serve 4 million students, the recurrent cost per student is still 88 percent of the per-student cost to serve 1 million. In this cost model, there are only minimal recurrent scale economies between 400 thousand and 2 million students.

Strong investment economies of scale and weak recurrent ones mean that for 50 thousand students, the per-student recurrent cost of an IRI program obeying our cost model specification would be only 30 percent of total cost, whereas for 4 million students, it would be fully 78 percent of total cost. The implication of this is that countries planning small programs should explore the possibility of using already-developed lessons from other countries to minimize investment cost. A second consideration for small program planners is what to do when donors finance initial investment costs on a one-off basis. When the next investment cycle comes around, the “sticker shock”

Figure 5-1: IRI per-student cost at various program scales—one instructional subject



Sources: World Bank—cost model presented in Tables 1 and 2.

may be profound (see financial issues later in the text).

Due to space limitations and deficiencies in country IRI cost data, we will not systematically present data for each of the countries that have had IRI programs. Rather we have developed a generalized cost model based on country data from Bolivia, Dominican Republic, Honduras, Lesotho, South Africa, and Venezuela. With suitable assumptions, the model is applicable to conditions in most countries. Cost estimates from this model are presented for a small scale program (100 thousand students) in Table 5-1 and a large scale program (1 million students) in Table 5-2. As shown in Chart 5-1, the cost model can be used to generate costs for programs at other scales. The assumptions used for the cost models are specified under the *program assumptions* at the top of each table. Other assumptions, of course, would have generated somewhat different results. Readers may make different judgments about the level of expenditure required for various items and can adjust the components accordingly. The model calculates investment cost, recurrent cost, and total cost for the specified program and the per-student cost for each of these categories.

Investment cost

In any IRI program, investment cost is bound to be a large part of the total cost. It is also the most variable. High quality scripts and programs

are more expensive than low quality ones—quality will be a program choice that will be made differently in different programs. At the low end of the scale, programs obtained from other countries are much cheaper than those produced fresh. Frequent revisions to the radio scripts and lessons are also expensive, but the revisions may extend a program's life span. Startup costs are sensitive to up-front training efforts and public information campaigns. Program coordinators will only be able to make rough estimates of the optimal amount needed for each of these items for their country's program. Thus, the estimates presented in the cost models represent one program specification. They assume original scripts and production of one instructional program. With these and other assumptions, the investment cost for a small scale program is US\$2.75 million and \$5 million for the large scale program. On an annualized basis,¹ investment costs constitute about two-thirds of the annual costs of the small scale program and one-third of those of the large scale program.

Recurrent costs

The big items of recurrent cost in the cost model are broadcasting costs, radios and their upkeep, and production and distribution of printed materials and cassettes, each representing about 20 to 30 percent of recurrent costs depending on the scale of the program. In the small scale program, administrative costs are in the same range, but in the large scale program, administration falls to 10 percent of recurrent costs.

Broadcasting costs refer mainly to air time but may also include supplemental payments to radio station personnel. It is the least understood cost among educators, and it is the one that is most varied in its financing. When state-owned national radio stations broadcast IRI programs without charge, there are still costs incurred to the country, if not to the MOE. The same is true of the "free" time offered by commercial radio stations. As the scale of the IRI program increases, both in terms of the number of radio markets and the num-

ber of instructional programs offered, it will likely be asked to pay for air time. Thus, for both analytical and financial reasons, the cost of air time should be planned for from the beginning of the project.

Radios and classroom materials, including radios, student and teacher guides, and cassettes, are the largest recurrent cost item in an IRI program. Hence, programs have tried to find ways to economize on their use. For example, when the school has electricity or windup radios available, batteries are unnecessary. Some programs have attempted to eliminate or reduce the need for distributing printed materials to classrooms by broadcasting the necessary text for students to copy, or by printing it in the local newspaper. This cost model has made little room for financing and distributing cassettes, but in areas not reached by radio stations or when programs are not broadcast during the school day, they would, nevertheless, be essential.

Training teachers is another highly variable cost among programs. There is general agreement that IRI programs typically fail most seriously in providing both up-front and continuing teacher training. It should be noted, however, that unlike other technologies, IRI has a built-in training function, amounting to "learning by doing," as teachers play their roles as instructed by the radio host. What the optimal amount of training should be is an open question. In the cost model, because of the general evaluation of under-training, we increased the annual recurrent training expenditure per teacher per year to \$10. This may still be inadequate, especially since one of the justifications for IRI in the first place is to help under-trained teachers compensate for their lack of training in certain subjects.²

Continuing program development is an item for which costs can also vary markedly from program to program. Some instructional programs may require only minor fine tuning. Others will be subject to continuous revision depending on

¹See Annex for the methodology used in annualizing investment costs.

²The allocation for teacher training in the AVANCE program in Honduras was only about \$1.60 in 1997.

Table 5-1: Costs of IRI programs in primary schools: typical schedule, small scale program^a

Program assumptions:									
Instructional subjects		1							
Students		100,000							
Students per class		30							
Participating classes		3,333							
Teachers (ratio 1.1: class)		3,667							
Participating classes per school		4							
Schools		833							
Radio markets ^b		7							
Number of schools per radio market		119							
Opportunity cost of finance (%)		10							
Life of radio programs and materials (yrs)		8							
Cost item	Unit	Investment amount per unit	Annual or annualized fixed program cost ^c	Annual or annualized variable cost per unit ^c	No. of units at given scale	Annual variable cost	Annual total at given scale	Annual cost per student	Annual %'age of total I+R costs
Investment cost									
Scripts	Subject	500,000		93,722	1	93,722	93,722	0.94	12
Radio program prod.	Subject	1,000,000		187,444	1	187,444	187,444	1.87	23
Printed materials, prep.	Subject	250,000		46,861	1	46,861	46,861	0.47	6
Startup costs (including upfront training)	Fixed	500,000	93,722				93,722	0.94	12
	Subject	250,000		46,861	1	46,861	46,861	0.47	6
	Class	75.00		14.06	3,333	46,861	46,861	0.47	6
Total investment cost^d		2,750,000	93,722			421,749	515,471	5.15	65
Recurrent cost									
Air time, other broadcasting	Radio market			10,000	7	70,000	70,000	0.70	9
Radios (3 yr. life)	Class	30		12.06	3,333	40,211	40,211	0.40	5
Radio repair/batteries	Class			3.50	3,333	11,667	11,667	0.12	1
Prod. print materials/cassettes	Student			0.50	100,000	50,000	50,000	0.50	6
Distr. of materials	Student			0.10	100,000	10,000	10,000	0.10	1
Trning/trning supplies	Teacher			10.00	3,667	36,667	36,667	0.37	5
Continuing prog. dev.	Part fixed, part per student	5,000	5,000	0.03	100,000	2,500	7,500	0.08	1
Admin. expense	Part fixed, part per student	40,000	40,000	0.20	100,000	20,000	60,000	0.60	7
Other fixed expense	Part fixed, part per student	5,000	5,000	0.03	100,000	2,500	7,500	0.08	1
Other variable expense	Class			1.00	3,333	3,333	3,333	0.03	0
Total recurrent cost			50,000			246,878	296,878	2.97	36
Total annual program cost			143,722			668,627	812,349	8.12	10000
Source: World Bank									
^a Based on actual costs from Bolivia, Dominican Republic, Honduras, Lesotho, South Africa, and Venezuela, adjusted for generality and inflation to 1997.									
^b Air time cost assumed to relate to the number of radio markets.									
^c Investment costs are annualized according to technique described in the Annex.									
^d Total investment cost calculated at given scale. In this table, 3,333 classes use \$75 per class in variable startup costs, for a total of \$250,000.									

COST AND FINANCE

Table 5-2: Costs of IRI programs in primary schools: typical schedule, large scale program^a

Program assumptions: Instructional subjects 1 Students 1,000,000 Students per class 30 Participating classes 33,333 Teachers (ratio 1.1: class) 36,667 Participating classes per school 4 Schools 8,333 Radio markets ^b 50 Number of schools per radio market 167 Opportunity cost of finance (%) 10 Life of radio programs and materials (yrs) 8									
Cost item	Unit	Investment amount per unit	Annual or annualized fixed program cost ^c	Annual or annualized variable cost per unit ^c	No. of units at given scale	Annual variable cost	Annual total at given scale	Annual cost per student	Annual %'age of total I+R costs
Investment cost									
Scripts	Subject	500,000		93,722	1	93,722	93,722	0.09	3
Radio program prod.	Subject	1,000,000		187,444	1	187,444	187,444	0.19	6
Printed materials, prep.	Subject	250,000		46,861	1	46,861	46,861	0.05	1
Startup costs (including upfront training)	Fixed	500,000	93,722				93,722	0.09	3
	Subject	250,000		46,861	1	46,861	46,861	0.05	1
	Class	75.00		14.06	33,333	468,610	468,610	0.47	14
Total investment cost^d		5,000,000	93,722			843,498	937,220	0.94	29
Recurrent cost									
Air time, other broadcasting	Radio market			10,000	50	500,000	500,000	0.50	15
Radios (3 yr. life)	Class	30		12.06	33,333	402,115	402,115	0.40	12
Radio repair/batteries	Class			3.50	33,333	116,667	116,667	0.12	4
Prod. print materials/cassettes	Student			0.50	1,000,000	500,000	500,000	0.50	15
Distr. of materials	Student			0.10	1,000,000	100,000	100,000	0.10	3
Trning/trning supplies	Teacher			10.00	36,667	366,667	336,667	0.37	11
Continuing prog. dev.	Part fixed, part per student	5,000		0.03	1,000,000	25,000	30,000	0.03	1
Admin. expense	Part fixed, part per student	40,000		0.20	1,000,000	200,000	240,000	0.24	7
Other fixed expense	Part fixed, part per student	5,000		0.03	1,000,000	25,000	30,000	0.03	1
Other variable expense	Class			1.00	33,333	33,333	33,333	0.03	1
Total recurrent cost			50,000			2,268,781	2,318,781	2.32	71
Total annual program cost			143,722			3,112,280	3,256,002	3.26	100
Source: World Bank ^a Based on actual costs from Bolivia, Dominican Republic, Honduras, Lesotho, South Africa, and Venezuela, adjusted for generality and inflation to 1997. ^b Air time cost assumed to relate to the number of radio markets. ^c Investment costs are annualized according to technique described in the Annex. ^d Total investment cost calculated at given scale. In this table, 33,333 classes use \$75 per class in variable startup costs, for a total of \$2,500,000.									

Table 5-3: Cost effectiveness of IRI: country evidence

Country/Intervention	(1) Year	(2) Student grades tested	(3) Subject	(4) Effect size (standard deviation units) ^a	(5) Cost per student (\$US) ^b	(6) Effect per \$US of cost ^c	(7) Source ^d
By intervention							
IRI							
Nicaragua	1976–1980	1-4	Math	0.55	1.80	0.31	1a
Thailand (Northeast)	1980	2	Math	0.58	0.44	1.31	1b
Kenya	1982–1984	3-5	Language arts	0.53	0.40	1.33	1c
Honduras	1990	1, 2	Math	0.49	1.01	0.49	2
Bolivia	1990	2-4	Math	0.90	0.81	1.10	2
<i>Average</i>						0.91	
Textbooks							
Philippines	1977	1	Math	0.40	0.27	1.48	1d
Nicaragua	1978	1	Math	0.36	1.75	0.21	1e
Thailand	1981	8	Math	0.06	0.25	0.24	1f
Brazil	1981–1983	2, 4	Reading/Math	0.34	1.65	0.21	1g
<i>Average</i>						0.54	
Teacher education							
Thailand–post-secondary math courses	1981	8	Math	<0.01	0.09	0.06	1f
Brazil–inservice primary	1981–1983	2, 4	Reading/Math	0.21	2.21	0.09	1g
<i>Average</i>						0.08	
By country							
Nicaragua							
IRI ^e	1976–1978	1	Math	1.10	1.80	0.61	1a
Textbooks	1978	1	Math	0.36	1.75	0.21	1g
Brazil							
Textbooks	1981–1983	2, 4	Reading/Math	0.34	1.65	0.21	1g
Teacher education– inservice primary	1981–1983	2, 4	Reading/Math	0.21	2.21	0.09	1g
Thailand							
Textbooks	1981	8	Math	0.06	0.25	0.24	1f
Teacher training	1981	8	Math	<0.01	0.09	0.06	1f
^a Calculated as the ratio of (a) the incremental performance of the intervention group over that of a control group to (b) the standard deviation of the performance of the control group. Since this ratio is independent of the units describing performance, it can be used to compare different interventions. ^b Costs are in dollars of the years of the programs. ^c Measure of cost effectiveness, i.e., incremental effectiveness per unit incremental cost. ^d Data for sources 1a-1g are from M. Lockheed and E. Hanushek, “Improving Educational Efficiency in Developing Countries: What Do We Know?,” in <i>Compare</i> (18:1), 1988; original sources 1a-1g are: (1a) Searle and Galda (1980) for effect, Wells and Klees (1978) for cost; (1b) Friend et al. (1986) for effect, Galda (1985) for cost; (1c) Oxford et al. (1986) for effect, Kemmerer and Friend (1985) for cost; (1d) Heyneman et al. (1985) for effect, Searle (personal communication) for cost; (1e) Jamison et al. (1981) for effect, Wells and Klee (1978) for cost; (1f) Lockheed et al. (1987); and (1g) Armitage et al. (1986). Data for source 2 are from T. Tilson, “Sustainability in Four Interactive Radio Projects: Bolivia, Honduras, Lesotho and Papua New Guinea,” in <i>Educational Technology: Sustainable and Effective Use</i> , The World Bank, 1991. ^e To facilitate comparison, the IRI results for grade 1 only are entered in this row.							

their educational impact. The very small amount allocated in our cost model would fund only minor fine tuning.

Cost effectiveness of IRI

The quality deficits identified in the educational performance of many developing countries, particularly in rural and urban-fringe areas at the primary level, have been of increasing concern in recent years. The international donors assisting them have sought cost-effective investments that will make a significant impact on educational quality. Various instructional interventions, such as textbook provision, teacher training using distance methods, computer-assisted instruction, and IRI are considered by policymakers, who desire solid evidence of both their effectiveness in raising student performance and their cost effectiveness.

The evidence gathered in Table 5-3 shows that IRI has been a cost-effective intervention in math and language courses in primary schools in a number of countries.³ There is also evidence that IRI is more cost effective than some textbook and teacher-training development programs. The average effectiveness/cost ratio of the IRI studies is 0.91, compared to 0.54 for textbook programs and 0.08 for teacher training.⁴ Unfortunately, only one comparison between IRI and another intervention in the same country has been made—in Nicaragua, where the IRI program was found to be three times as cost effective as a textbook program (see Table 5-3).

An observation on the per-student cost figures for IRI in Table 5-3 is that they are sufficiently variable to raise the question of whether all costs

incurred by the programs were included and, if so, whether there was significant underspending in major areas, such as IRI training for teachers. Except in the case of Nicaragua where, even allowing for dollar inflation, the per-student costs are also considerably lower than those estimated in the cost model of Tables 5-1 and 5-2, this is probably due to a combination of undercounting costs such as air time and the effect of options taken in some programs, e.g., low spending on IRI training for teachers. In cases where program options produce lower costs, the measure of cost effectiveness would not be biased upward. For instance, assuming that the teacher training was low quality in a given program, the effectiveness results are still the results for the entire program. In the case where the low cost is due to cost undercounting, however, the cost effectiveness measure *would* be biased upwards. Even in this instance, though, the comparison with textbook and teacher-training programs might not be biased, because the costs of these programs might also have been underestimated.

These results should not be viewed as the last word on the relative merits of the three interventions, particularly since the research data was collected early in the development of IRI. However, they should serve as a wake-up call to education ministries and the education community in general to give serious consideration to IRI as a reliable and cost-effective tool for tackling the systemic problems of severely underfunded education systems and increasing student performance over a wide range of circumstances.

Affordability of IRI

If the cost-effectiveness analysis points to the potential for IRI to play a larger role, can countries afford it? Affordability is an imprecise but meaningful concept in educational planning. While semantically cast in terms of necessity—*can or cannot afford*—it should more accurately be phrased *choosing to afford or not afford*. In general, certain budgetary categories are off limits when new quality-enhancing programs are proposed for financing. What is not affordable at one

³Most of the results are taken from Lockheed and Hanushek, op. cit., 1988, which summarized and analyzed a number of other studies.

⁴The effectiveness–cost ratio is the size of the effect divided by the incremental cost to produce it. The measure of effect commonly used for comparing the effect of different interventions is standardized by dividing (a) the incremental performance of the intervention group over that of a control group by (b) the standard deviation of the performance of the control group. Since this ratio is independent of the units describing performance, it can be used to compare different interventions.

Table 5-4: Public expenditure on primary teaching materials, 1993

Country	GNP per capita (\$US)	Per-student public expenditure on primary ed. (\$US)	Public expenditure on primary teaching materials (\$US)	Percentage of total spending	Primary pupils/teacher
Mauritania	500	64	1.6	2.5	53
Suriname	830	83	3.6	4.4	
Swaziland	1,140	92	0.03	0.04	33
Czech Republic	2,700	1,114	290.1	26.0	21
Malaysia	3,090	336	25.4	7.6	20
Oman	5,190	870	18.9	2.2	27
Slovenia	6,590	1,518	17.9	1.2	16
Republic of Korea	7,720	1,136	16.0	1.4	31
Average	3,470	652	47	5.7	29

time, however, becomes affordable at another as political, macroeconomic, and donor-assistance conditions change. The actual level of discretionary spending is as different from country to country as the range of political and economic choices. With a strong enough budgetary effort, discretionary spending can be increased, for example, by allowing student-teacher ratios to increase somewhat, thereby reducing expenditure on teacher salaries. Increased cost recovery efforts in higher education could provide the wherewithal for a reallocation of funds within the education budget. Improved macroeconomic and donor-assistance conditions may also allow increased discretionary spending at certain times.

In another sense, however, affordability is not a choice. It is doubtful that Chad, with a per-capita GNP of US\$270 and a current per-student primary expenditure of \$26, would choose to spend \$100 per student on programs designed to enhance the learning performance of primary students by improving teacher training, enhancing textbook provision, expanding computer-assisted instruction, or increasing Internet access. Thus, in a given country at a given time there is a real, if not precisely measurable, upper boundary to discretionary primary spending within which quality enhancement programs and attacks on systemic problems must realistically fit. As a rough and ready measure for this, we have used 20 percent

of the current total primary education budget, which is not to say that countries are prepared to allocate potential discretionary spending to such activities. For example, spending on teaching materials is one indicator of how far below the upper boundary of discretionary primary spending most developing countries now are. Data on spending on teaching materials for 1993 are presented in Table 5-4. These percentages of budgetary expenditure, except in the case of the Czech Republic, typically range from 1 to 8 percent.⁵

Tables 5-5 and 5-6 present estimates (for thirty-one countries) of the cost of the small and large scale IRI programs as a percentage of per-student potential discretionary spending out of the budget for primary schools. Using 20 percent of the primary budget as its measure, small scale IRI programs in lower income countries would require on average 84 percent of potential per-student discretionary primary spending. Thus, students using the IRI program would need to be allocated a much higher per-student expenditure than those not taking it. Were the program made large scale, however, the percentage would drop to 23 percent of per-student discretionary primary spending. For lower-middle-income countries, these average percentages would drop to 32 percent

⁵These figures should not be construed to reflect total expenditure on teaching materials, since as a rule neither donor nor parent contributions are included.

(small scale project) and 9 percent (large scale project). For upper-middle-income countries the figures would be 7 percent and 2 percent for small- and large scale projects.

Thus, in the middle-income countries, IRI programs at costs estimated in this paper would be straightforwardly affordable within existing budgetary frameworks. While IRI programs are affordable “on average” for the whole sample, they may not be for individual countries. For example, the Dominican Republic’s budgetary per-capita expenditure for primary education lags behind that of other lower-middle-income countries. The Dominican Republic’s total per-student cost of the small scale program would cost 113 percent of potential discretionary primary spending, and the large scale program, 45 percent. Conversely, Bulgaria, with a slightly smaller GDP per capita than the Dominican Republic, would require only 11 percent of its potential discretionary primary spending for a small IRI program and 5 percent for a large program.

It is also useful to look at the financing of recurrent costs, because in many of the poorest countries, donor finance may be available at grant or concessional rates to finance capital costs. Donors may also be able to import mathematics, English, or Spanish programs that require little or no adaptation to country conditions (and thus considerably reduce capital costs). In addition, the poorest countries may need to cover only a portion of recurrent costs over the medium term, which for the countries in the sample average 12 to 31 percent of our measure of potential discretionary primary spending (Tables 5-5 and 5-6). For the two groups of middle-income countries, average recurrent costs as a percentage of potential discretionary primary spending is in only the 1 to 12 percent range, which should be affordable in these countries.

The conclusion is that IRI should be readily affordable for most countries. In many of the poorest countries, however, while IRI would be affordable even without donor assistance, it would require making difficult budgetary choices. Be-

cause of the greater budgetary effort required by such countries, donor assistance may be justifiable.

One argument worth making to governments considering funding IRI programs is that they can reduce repetition, a major cause of inefficiency in many educational systems. By reducing the cost per student, an education system could offset, in whole or part, the cost of the IRI program. Unfortunately, the savings resulting from increased efficiency will come only after the major expenditures for IRI have been made and student performance has improved. Capturing these funds for an IRI program would be difficult.

FINANCING ISSUES

The concepts of *cost* and *finance* should be clearly distinguished in the minds of decisionmakers. It is important to know the real cost of an intervention in order to know whether it is worth investing in. Once a decision on the merit is made, however, questions of financial feasibility and sustainability need to be examined.

Sources of financing

Among the sources of financing for IRI programs, outside of MOEs and parents, are ministries of information, public broadcasting entities, private radio stations, local governments, communities, teachers, NGOs, private in-country donors, and international donors. They constitute a set of financial sources probably broader than those for any other major educational intervention. Table 5-7 provides an idea of the range of financing sources utilized by IRI programs in several countries.

The broadcasting authorities—either a cabinet-level ministry of information, an independent broadcasting organization, or both—may be sources of funds not usually available to educational programs. Funding for IRI from the information side is usually in the form of free or reduced-price air time, the use of recording and editing studios, and the services of broadcast staff. The free or reduced-price air time may be offered

Table 5-5: IRI total cost relative to primary education budget, small scale program,^a 1993 (US\$)

Country	(1) GNP per capita	(2) Per-student annual public expenditure on primary education	(3) Potential discretionary spending: 20% of (2)	(4) Percent of potential discretionary spending	(5)	(6) Percent of total spending	(7)
				IRI recurrent cost	IRI total cost	IRI recurrent cost	IRI total cost
Lower income							
1 Ethiopia	130	74	15	20	55	4	11
2 Chad	210	26	5	57	157	11	31
3 Kenya	270	48	10	31	85	6	17
4 Mali	300	53	11	28	77	6	15
5 China	490	27	5	54	148	11	30
6 Mauritania	500	64	13	23	64	5	13
7 Zimbabwe	550	104	21	14	39	3	8
8 Lesotho	670	84	17	18	48	4	10
Average	390	60	12	31	84	6	17
Lower middle income							
9 Macedonia, FYR	820	182	36	8	22	2	4
10 Suriname	830	83	17	18	49	4	10
11 Guatemala	1,060	66	13	22	61	4	12
12 Swaziland	1,140	92	18	16	44	3	9
13 Romania	1,200	260	52	6	16	1	3
14 Bulgaria	1,220	353	71	4	11	1	2
15 Dominican Republic	1,260	36	7	41	113	8	23
16 Paraguay	1,540	121	24	12	34	2	7
17 Tunisia	1,680	226	45	7	18	1	4
18 Slovak Republic	2,130	470	94	3	9	1	2
19 Costa Rica	2,230	235	47	6	17	1	3
20 Poland	2,240	330	66	5	12	1	2
21 Ukraine	2,440	1,044	209	1	4	0	1
Average	1,522	269	54	12	32	2	6
Upper middle income							
22 Czech Republic	2,700	1,114	223	1	4	0	1
23 South Africa	2,990	1,069	214	1	4	0	1
24 Malaysia	3,090	336	67	4	12	1	2
25 Chile	3,190	273	55	5	15	1	3
26 Hungary	3,510	912	182	2	4	0	1
27 Mexico	3,800	297	59	5	14	1	3
28 Oman	5,190	870	174	2	5	0	1
29 Slovenia	6,590	1,518	304	1	3	0	1
30 Argentina	7,260	1,175	235	1	3	0	1
31 Republic of Korea	7,720	1,136	227	1	4	0	1
Average	4,604	870	174	2	7	0	1

^aSmall scale IRI program is assumed to be 100 thousand students.

COST AND FINANCE

Table 5-6: IRI total cost relative to primary education budget, large scale program,^a 1993 (US\$)

Country	(1) GNP per capita	(2) Per-student annual public expenditure on primary education	(3) Potential discretionary spending: 20% of (2)	(4) Percent of potential discretionary spending	(5)	(6) Percent of total spending	(7)
				IRI recurrent cost	IRI total cost	IRI recurrent cost	IRI total cost
Lower income							
1 Ethiopia	130	74	15	8	15	2	3
2 Chad	210	26	5	23	43	5	9
3 Kenya	270	48	10	12	23	2	5
4 Mali	300	53	11	11	21	2	4
5 China	490	27	5	22	41	4	8
6 Mauritania	500	64	13	9	17	2	3
7 Zimbabwe	550	104	21	6	11	1	2
8 Lesotho	670	84	17	7	13	1	3
Average	390	60	12	12	23	2	5
Lower middle income							
9 Macedonia, FYR	820	182	36	3	6	1	1
10 Suriname	830	83	17	7	13	1	3
11 Guatemala	1,060	66	13	9	17	2	3
12 Swaziland	1,140	92	18	6	12	1	2
13 Romania	1,200	260	52	2	4	0	1
14 Bulgaria	1,220	353	71	2	3	0	1
15 Dominican Republic	1,260	36	7	16	31	3	6
16 Paraguay	1,540	121	24	5	9	1	2
17 Tunisia	1,680	226	45	3	5	1	1
18 Slovak Republic	2,130	470	94	1	2	0	0
19 Costa Rica	2,230	235	47	3	5	1	1
20 Poland	2,240	330	66	2	3	0	1
21 Ukraine	2,440	1,044	209	1	1	0	0
Average	1,522	269	54	5	9	1	2
Upper middle income							
22 Czech Republic	2,700	1,114	223	1	1	0	0
23 South Africa	2,990	1,069	214	1	1	0	0
24 Malaysia	3,090	336	67	2	3	0	1
25 Chile	3,190	273	55	2	4	0	1
26 Hungary	3,510	912	182	1	1	0	0
27 Mexico	3,800	297	59	2	4	0	1
28 Oman	5,190	870	174	1	1	0	0
29 Slovenia	6,590	1,518	304	0	1	0	0
30 Argentina	7,260	1,175	235	1	1	0	0
31 Republic of Korea	7,720	1,136	227	1	1	0	0
Average	4,604	870	174	1	2	0	0

^aLarge scale IRI program is assumed to be 1 million students.

Table 5-7: Country data on sources of funding

Country	(1) ^a Year	(2) National MOE budget	(3) Local gov't budgets	(4) Public radio entity	(5) Private radio stations	(6) NGOs, donations, communities	(7) Parents	(8) Teachers	(9) Donors
South Africa	1992+	x	?	x		x			x
Bolivia	1987+				?	x			x
Honduras	1987+				?	x			x
Lesotho	1988+	x		x			x	x	x
Dom. Republic	1990+					x			x

^aThe plus (+) sign indicates succeeding program years as well as year indicated.

at times when direct reception in the classroom is impractical, however. Thus, utilizing it requires teachers to record the radio lessons on audio cassettes and then to use the cassettes in the classroom. These extra demands on teachers, the problems of maintaining the tape recorder, and the supply and management of cassettes all introduce extra complexity into an IRI program. In countries and rural regions where institutional capacity is weak, this extra complexity could prove harmful.

Private radio stations are often willing to run IRI programs at reduced rates or even at no charge. The question marks in Table 5-7 signify the question of whether the putative rate concessions that occurred were because IRI was perceived as “community service” or simply an indication of rational pricing. In Bolivia and Honduras, private radio stations were used to broadcast the IRI lessons and received substantial negotiated payments. These rates may have included a community service discount—essentially a contribution by the radio stations—in which case the stations should be considered a source of funds from a private donor. However, even free air time does not necessarily indicate a community-service motivation. Some financially constrained stations might be happy to have IRI programming simply to fill in gaps in its schedule; in this case, the zero charge for the time may simply reflect the zero profit potential of the time slot.

Donors can play a crucial role in the finance of IRI programs, both because they bring money to induce and sustain the intervention during ini-

tial phases (especially important because of IRI’s large up-front investment costs), and because they can provide expertise to validate the program’s educational effectiveness. Donors may also be able to provide radio scripts and complete broadcast-ready lessons from other countries, which, when needing only minimal adaptations to local conditions, can result in significantly reduced initial investment. For example, English-as-a-second-language scripts from Kenya needed only minor editing to be used in Lesotho, and math lessons from the Nicaragua program have been used in other Spanish-speaking countries. Finally, in times of financial stringency, donors may provide episodic support for such items as print materials.

Those working in education in developing countries know of situations where the MOE’s budget is not sufficient or reliable enough to provide textbooks, exercise books, or even chalk in schools. In addition to budget shortages, the logistics of commodity supply have been difficult in some countries. Thus, it is no surprise that supplying student workbooks, teacher guides, radio repair, and batteries has been a difficult hurdle for some IRI programs, especially in rural or peri-urban areas where their potential impact is greatest. As with textbooks and exercise books in such countries, parents often voluntarily (or as a requirement) finance these items. Some programs, as in Lesotho, have even been designed to recover costs from parents. When a power supply is lacking, batteries for the radios have been a particularly crucial and difficult item. Rather than see IRI lessons stop for lack of batteries, parents and teachers have often paid for them.

NGOs, businesses, philanthropists, and local governments have also been active financially in IRI programs. Their involvement has been beneficial beyond the finance they provide through their mobilization of political support for the programs. But unlike textbook programs or teacher training, broad financial and political support can reduce the sense of ownership within an education ministry and thereby undermine the quality of its IRI leadership.

FINANCIAL SUSTAINABILITY

Program sustainability in general and financial sustainability in particular are related to the quality of leadership and commitment. While the affordability discussion showed that IRI is affordable in most developing countries, the cost is nevertheless still substantial, particularly when compared with non-personnel budgets in primary education. Thus, financing IRI through the government budget when donor funds are no longer available requires sustained political and institutional commitment. There are, however, three specific financial sustainability issues that merit discussion and can be used to bolster the arguments for government financing of IRI. The first concerns the impact on financial sustainability of the strong economies to scale and the lumpiness of investment that characterize IRI programs. The second is the broadcasting link. And finally, there is cost recovery from parents.

Economies of scale and lumpiness of investment

IRI programs, especially those of relatively small size that have not invested substantially in continuing radio lesson development, ultimately face large costs for new scripts, lesson production, and preparation of printed materials. In some subjects, instructional obsolescence is more rapid than in others, but even those programs with little subject-matter obsolescence are prone to obsolescence in teaching methods and in the topicality of interest-enhancing features such as recognized entertainers. For instance, the drill-and-practice scripts of some early IRI lessons are unacceptable

to many educational reformers in today's constructivist era. Both small, continuous, and large episodic investment in scripts and program production appear to be required to maintain the enthusiasm of key decisionmakers and teachers. Without this enthusiasm, the IRI program will gradually lose favor and eventually be terminated. One reason that the investment required to maintain interest may not be forthcoming is that it is often quite "lumpy." Large investments at periodic intervals are not as easy to obtain as an investment program that is more evenly—and predictably—distributed. This argues for continuous program development to maintain teacher interest, and a relatively even annual investment schedule that allows for a constant commitment of resources by the government. It suggests a phased investment schedule involving several instructional subjects so that a relatively even investment program, like that in Venezuela, can be combined with the necessity to realize economies of scale in lesson production. Such phased investment can be sensibly incorporated into a government budget plan.

Support from broadcasters

One key aspect of ministries of information and public and private broadcasters as funders of IRI is that they respond to different incentives from MOEs and schools. While broadcasters are often sensitive to their role in public service, helping schools provide instructional programs is just one opportunity among many. At the political level, they are responsive to a variety of constituencies, and education agencies are just one among many. The fact that fashions in programming are likely to change rapidly adds another element of instability. At the commercial level in most countries, both publicly and privately owned broadcasters go through advertising revenue cycles. In prosperous times, this revenue allows broadcasters to finance sufficient programming to fill their schedules and attract audiences and advertisers. In lean times, including the period before they are fully established, stations are constrained in the quantity and quality of programming they can purchase. At such times, ready-made educational program-

ming becomes very attractive, since it can fill in large, otherwise empty spaces in their schedules and allow them to concentrate available funds on programs to attract prime-time viewers. These imperatives affect both government-owned as well as private radio stations.

As both government and commercial stations become better established or more prosperous, their ability to attract viewers and advertisers in daytime slots increases, and the attractiveness of allocating large blocks of free or highly discounted air time to assist the instructional objectives of schools is proportionately reduced. They may come to regard their IRI obligation, and other kinds of public-service broadcasting, as onerous and try to restrict the amount of concessional air time or the availability of time during the school day. The implication of this is that funding from broadcasters may be unreliable and decrease over the life of an IRI program. IRI programs dependent on free air time from government broadcasters, and even IRI programs that purchase air time from private broadcasters, may face increases in rates or decreases in availability and usability of time slots.

A second problem for financial sustainability from the radio side lies in what might be termed “financial shock.” If part of the financing of IRI has been borne by a national or local broadcasting entity and that entity suddenly withdraws assistance or changes the terms of its offer in unfavorable ways, the IRI program may have to be discontinued, even though the additional strain on the education budget to compensate for the loss of subsidized air time could theoretically be manageable.

For all these reasons, IRI programs need to recognize the problems of financial sustainability that can arise on the broadcast side and plan ahead to minimize them through long term contracts, close attention to political support (which may affect the willingness of government broadcasters to support IRI), and financial provision for increased broadcasting expense. Managing the financial side of broadcasting thus may be one of

the key elements of program success and long-term survival.

Support from parents and others

Cost recovery can be an effective means of protecting IRI programs from threats of closure. Threats to radio instruction from an inability to obtain radio batteries, radio repair, or student workbooks because of budgetary shortfalls can be overcome by charges and voluntary contributions from parents as well as through donations from teachers and other community sources. These charges and contributions are made possible once the IRI program has generated strong parental, teacher, and community support. Building some level of cost recovery into an IRI program from the beginning can potentiate this source of financing and create fertile conditions for growth when necessary.

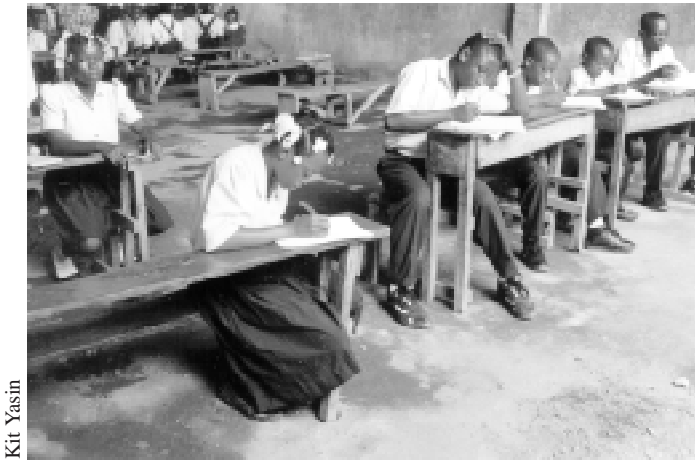
Parental and community financing can help create ownership and influence school-level policies. These in turn can also affect the likelihood of the IRI program’s being sustainable. When contemplating certain public disapproval, government broadcasters and their political patrons will be less likely to make arbitrary cutbacks in financial support or broadcast conditions.

In essence the key elements for long term government support of an IRI program are:

- recognition of the effectiveness of IRI as an affordable means of tackling the systemic problems of equity and access, while making real progress in the quality of teaching and learning gains;
- appreciation of the varying financial demands made by a developing IRI program, and ensuring by careful anticipation of these demands in the budget that they can be met;
- respect for the ownership and commitment generated for IRI in teachers and parents and recognition that these qualities have potential value in the political arena.

6. SUCCESS AND SUSTAINABILITY

BY ALAN DOCK



Kit Yasin

Many of the projects discussed in this book, including those that have disappeared, are considered to have been successful by their funding agencies and country sponsors. Success or failure in this context is a narrow performance-related concept. Did the project achieve its stated objectives? Did learning gains occur? Were funds fully disbursed? IRI projects clearly have been successful in expanding access, promoting equity, and improving teaching quality and learning gains. But in many countries that have introduced IRI, the education system still generates poor-quality teachers and contains classrooms in which mediocre learning gains are the norm. To have significant impact on this endemic problem, IRI needs to be sustained until it is no longer merely a supportive element in maintaining quality education, but becomes such an integral part of the system that it no longer invites separate scrutiny. A very important indicator of success of IRI as a methodology, therefore, lies in how well a project is *sustained* until quality teaching and a conducive learning environment are the norm for all learners. Without this long term sustainability, impact on the in-

trinsic quality of the system may be localized and short lived.

DEFINING SUSTAINABILITY

Sustainability has been defined by the World Bank as “the ability of a project to maintain an acceptable level of net flow of benefits throughout its economic life.” While the Bank’s definition would be the easiest to demonstrate, the success or failure of an education project cannot only be determined by learning gains, the amount of funds disbursed, or even the achievement of immediate project objectives alone. In studying the sustainability of education projects, the World Bank definition can be amplified as follows:

- *A project is a development process.* In the long term, an IRI project, while providing for the learning needs of the immediate student group, is part of a gradual improvement process that the education system is undergoing. This may entail an expansion of the IRI pilot program to cover more students or subjects, or it may mean the eventual phasing out of IRI as the system improves its conventional teaching capacity.
- *In order to agree on a level of benefits, an initial benchmark is required.* In the education sector, benchmarks are frequently results of pre- and post-tests, spreadsheets of expenditures, and statistics on enrollment trends, promotion, repetition, dropout, ages, gender percentages, etc. Quantitative indicators, themselves indicative of *qualitative* changes in the system, can also be supported by indirect indicators of quality improvements such as teacher enthusiasm

Box 6-1: Factors governing sustainability

External factors	Internal factors
<ul style="list-style-type: none"> ■ Appointment of consistent, high quality, caring leadership ■ Financial security ■ Political support ■ Integration of the program into the administrative and professional fabric of the education system ■ Training of teachers and program facilitators 	<ul style="list-style-type: none"> ■ Management ■ Technical coordination ■ Timely inputs ■ Training, supervision, and nurturing ■ Evaluation ■ Long range planning and budgeting

and increased length of service, parental support and the growth of parent–teacher associations, and the spread of innovations into non-targeted areas of the system. The net benefits are determined through an analysis of changes in these factors over time.

- *The flow of net benefits, measured in terms of indicators of the quantitative and qualitative outcomes of the initiative over time, places the emphasis on the maintenance of net benefits rather than on the survival or continued existence of a particular project.* Thus, there is an emphasis on the evolutionary nature of development, i.e., it occurs over a period of time during which a particular project may disappear. Yet the project’s institutional capacity may well resurface in a related project or become an integral part of the education system.
- *The economic or productive life is the period over which the project is written off or the period over which it continues to produce “acceptable” net benefits—including the “inherited” benefits described above.*

PROJECT DESIGN ELEMENTS

With this definition of sustainability, a project design should stress:

- the processes for maintaining the flow of benefits; and
- the possibilities for extending the economic life of the project, i.e., the gradual absorption of recurrent project costs into the annual education budget; the extension of the concept specifically to the post-completion period, emphasizing the transition at the end of the loan, grant, or contract period to the post-completion stage when the project will no longer be funded by the loan, grant, or contract. This allows a distinction to be made between “project performance” (evaluated over the development period) and “project sustainability” (evaluated for the post-completion period). This distinction requires the project design to contain specific local capacity building elements and an agreed plan for phased changes in the local institutional structure that will eventually enable the program and its administration to be absorbed into the system.

WHAT FACTORS GOVERN SUSTAINABILITY?

Answers to the questions about sustainability posed in Chapter 2 are found in a number of key factors derived from the case studies. Five of these factors are more or less *external* to the projects; and six factors are more or less *internal*. In our

analysis we have noted that the absence of one or more of the external factors results in a rapid decline or even disappearance of the project, while insufficient attention to the internal factors has a deleterious effect on the quality of the product and therefore an indirect but equally negative effect on long term sustainability. Box 6-1 summarizes these factors. Although the division between external and internal is to some extent artificial, it is a useful concept for the following discussion.

External factors

Leadership. If any one factor should be identified as paramount, it is leadership. All of the highly successful IRI projects have at their helm a dynamic, often charismatic individual who invests personal ambition and status in the project. This individual creates a flexible growth-oriented organization to house the development and initial implementation stage of the IRI intervention, hires young or mid-career principal staff dedicated to the aims of the program, creates a democratic, team-leadership working style, and maintains close and cooperative relationships with donor and beneficiary agencies.

Financial support for sustainability. In the development phase of a project, financial security is not typically an issue where an external funding agency is involved. The funding agency commits funds for the number of years needed to ensure full achievement of the program objectives. However, there comes a time when the donor funding ceases. At this point it must be determined how the program can be sustained, and, in most cases, how it can be expanded. Have the recurrent costs been adequately determined and financial plans made? What changes in structure and management are needed to assure sustainability following the end of donor involvement?

In order for the program to be sustained, three major cost areas must be covered: (1) radio transmission; (2) teacher guides, student materials, radio repair or replacement; and (3) program management, supervision, and training.

Radio transmission costs include the cost of the broadcast studio, actual transmission, and storage and handling of tapes. While such materials as teacher guides, readers, and posters can be used over a period of years, student materials, including workbooks, readers, and student kits must be supplemented annually to cover wear and tear and theft. Radios are stolen and need to be replaced, and some require repair. Financial provision for regular distribution of materials and replacement equipment must also be budgeted.

Costs for expansion of an IRI program would include all the above as well as the cost of planning and organizing the expansion process, new radios, and promotional materials. It may be deemed necessary at some point to revise the teacher guides and student and classroom materials. This would generate concurrent costs in the preparation and recording of new lesson scripts.

Integral consideration in the project design should be given to creating a realistic strategy that provides for the transition from donor funding to a funding line in the budget of the implementing agency and the identification of resources to cover that budget.

Political support. Political change over the life of a program is almost a certainty in many countries. It is essential that there be advocates in place to lobby for the IRI initiative within the changing reform groups that arise as a consequence of or precursor to political change. To increase the likelihood of sustainability, the project needs to be promoted to universities, pertinent NGOs, business and industrial associations, congressional and intellectual leaders, and politicians themselves. In support of this strategy, advocacy and support from the wider community outside the regular public educational system are also needed (shadow audiences, parent-teacher associations, community groups, the media etc.). Finally, it is important to assess how much clout the implementing institution, e.g. an education ministry or NGO, has to influence the government to provide the financial stability required for sustainability and expansion.

Integration into the system. A common characteristic of the discontinued projects we have reviewed is that they were poorly integrated into the administrative and professional structure of the education system. Many projects in the development phase are dominated by donor or loan control agencies. Where this is the case, a key element in successful transition to government or local control is a project component, present from the outset, whose objective is to complete the integration of the project into the local structure. This component gives attention to maintaining a healthy working relationship between the funding agency and the power centers in government, educating government on likely needed recurrent expenditures, training local implementation and administrative personnel, and gradually shifting responsibility for the project to appropriate local structures. Very often these structures are themselves evolving, and it is important that funding agency staff are sensitive to national realities. For example, if the MOE has decentralized recently, is there a mechanism (human resources, budget) for sustaining the intervention throughout the system?

Finally, in its ongoing dialogue with government, advocacy by the donor institution or funding agency is essential to generate stakeholder interest and an ability to work for maximum impact and sustainability.

Training of teachers and program facilitators. We discovered that some teachers, after working with an IRI program for a few years, especially in countries where regular supervision and continuous training are lax or nonexistent, become bored. They complain that programs are repetitious, ask that the broadcasts be scaled down to two or three times a week instead of daily, leave the classroom during broadcasts, or simply fail to use the programs regularly. Clearly, training new teachers to perform their role as classroom facilitators is important, but equally important is regular inservice contact and retraining of teachers already in the system. Classroom teachers need to know that people in district, regional, and national offices care about them and the IRI program. In addition to rekindling teacher enthusiasm, such inservice

training serves a second important purpose: providing a channel for fine-tuning the program and its lesson materials while building a solid sense of participation and ownership in those classroom implementers.

If district, regional, and national officers—and even the project implementers themselves when carrying out their supervisory and evaluative responsibilities—are to convey this caring and involved attitude to the teachers, they too will need to be trained in the overall objectives of the program and become sensitive to the needs of teachers and the problems that exist in the classroom. The introduction of a regular “teachers’ magazine” radio program, carrying inputs from the teachers themselves, is another powerful mechanism for maintaining enthusiasm in the classroom.

We believe that while such broad-reach training components are expensive, they are absolutely essential for real sustainability to occur.

Internal factors

Internal factors are also important in ensuring the quality of the IRI project, and therefore improving its chances of becoming sustainable. Circumstances in every country differ, making it difficult to prescribe a generic framework for the organization, development, and implementation of IRI interventions. However, we have been able to identify several common key issues and ingredients that are internal to an IRI program.

Management. Good management, or technical leadership, is an important part of a sustainable IRI program, and a factor that is often overlooked or misconstrued. Management should not be confused with *leadership*, described above. USAID has traditionally contracted a consulting firm to manage technical assistance in the development phase of a project, and the consulting firm has provided a chief-of-party who assumes the role of chief technical advisor and may play a significant part in the project management. The host country institution is asked to provide a director or counterpart to the chief-of-party. This person

is usually an educator, typically a former teacher, who has been promoted to administrative and managerial duties in the MOE or host institution. In many cases the counterpart director has not received any formal management training. The focus of the development phase is on development, pilot implementation, and evaluation of the product, all of which require good management skills. In earlier IRI projects, the long term scaling up of the program was not perceived as an important issue, because the main objective was to prove that the intervention was effective before turning it over to the host institution. Technical leadership, however, is essential if the longer-term issues and objectives associated with going to scale are to be kept in the collective mind of the education system. Local management of the project is a key element in establishing the ownership and commitment that leads to such leadership. More recent projects are beginning to address leadership and effective local management issues more directly.

One successful strategy adopted by projects in South Africa and Venezuela is to appoint two host institution principal specialists, a general manager and a technical director. The former would be the host institution's project leader, who is responsible for promotion, fundraising, budgets, contracts, logistics, overall administration, and liaison with institutional superior authorities, donor or loan agencies, and other related institutions. The latter would coordinate program development, supervision, training, and evaluation. The role of the funding agency chief-of-party should be as low key as is commensurate with efficient management of the program. In all cases, the chief-of-party should be a tutor or mentor to the in-country management team. Eventually the general manager assumes the leadership of the project when external support is withdrawn, while the technical director would become the deputy responsible for day-to-day implementation of the program.

In order for this strategy to work well, the country principal specialists should be chosen carefully. Political pressure and cronyism can be resisted by involving the donor or loan institutions

in defining the profile, criteria, and recruiting procedures for the top management positions. The general manager should ideally possess administrative and public relations credentials, and command a high degree of credibility with the host institution, the government, and the national academic and political communities. The technical director should be an educator with academic qualifications and significant hands-on experience in education at the level at which the intervention will operate. Some media or communications experience would also be advantageous. The technical director's personal profile should contain strong evidence of an ability to inspire, lead, and manage the technical work teams. Both should demonstrate project work experience and an ability to meet deadlines. Where appropriate, management and leadership training should be built into the initial phase of the project.

From the beginning of the development phase, the general manager should set sights on sustainability and the largely external factors that govern this, while the technical director should focus on quality product development. Information on costs should be gathered and budgets developed in concert with any technical assistance contractor or donor or loan institutions. The development of a long range implementation plan, including a budget forecast, should be a major objective for the general manager.

Instead of preparing reports to satisfy and inform the donor and host institutions, the manager should prepare reports, promotional brochures, newsletters, news releases, etc. to communicate to the users (teachers, school directors, and other MOE departments and units), the potentially wider constituency (academic, political, union, and business-industrial groups), and the national media. The formation of advocacy groups should be another major objective of the general manager.

A highly competent general manager can do much to organize and promote an image of the project as owned and implemented by national agencies, beginning with the establishment of a memorable and attractive name and logo. Most

importantly, it is the task of the general manager to ensure that the head of the host institution (the minister or secretary of education in most cases) is visibly supporting the program, perhaps by engaging in dialogue with advocacy groups or leading promotional activities, especially those targeted as fundraising.

Technical coordination. During the development phase, the technical director should focus attention on the recruitment, selection, and training of qualified personnel, and only then on the actual development of a quality product. Finally, throughout the life of the project, the technical director should nurture the participation of teachers, school principals, and supervisors.

The key to a developing a quality product is having a highly qualified and dedicated staff of scriptwriters, producers, actors, evaluators, and trainers. Well-defined job descriptions and recruiting procedures should be prepared and adhered to. Since the availability of staff of this caliber is often limited, an integral training component for the program is essential. This should be one of the principal tasks of any technical assistance provided from outside the project.

Timely inputs. When radio is used, all involved are subject to exact timing. The radio transmission waits for no one. Essential product ingredients must be delivered on time. Scripts must be written and reviewed, and lessons produced in time to be aired. Formative evaluation, which entails observation in classrooms, must happen at the appropriate time if it is to be of value to the ongoing design process. Thus, logistics must be organized and transportation and per diems provided. Office supplies and production equipment must be on hand.

Decisions must be made concerning the need and provision of teacher guides and student workbooks and readers. There are advantages in making the radio programs as autonomous as possible, especially if one of the goals of the program is to overcome the obstacles of delivering print materials. But if print materials are to be provided, care-

ful thought will be required, not only to write, but to publish and distribute them as well. Should the written materials be bound, stapled, or assembled in a ring binder? Will they be permanent documents or subject to modification or additions? How will the materials be distributed, and at what cost, both now and in the future?

Should an investment be made in a recording studio? This should be weighed against the availability and quality of rental or bartered facilities. The production of a one-half hour lesson usually requires an average of four hours of recording studio time—sometimes longer if there are many part-time employees such as actors, editors, and producers involved. Using others' facilities often creates problems. An investment in the best and newest equipment and the reconditioning of adequate space for its installation may seem a high cost, but in the long run it may prove more efficient, expedient, and economical.

Training, supervision, and nurturing. As we have mentioned, teachers are the fundamental ingredient of a successful IRI program. They must be properly trained to manage an IRI classroom, and need to be continually “nourished.” Trainers must avoid “giving orders” or creating the impression to teachers that they are subordinate to the IRI system. It is first necessary to show teachers the advantages of the IRI product and induce them to “buy” it. If teachers feel they are being obligated to use IRI, they will most often reject it or be indifferent to it. The fundamental error many training programs make is to “market” the approach and then fail to provide “after-the-sale” followup. It is often assumed that if a teacher “volunteers” to participate in an IRI program, he or she is positively disposed and has accepted it, so the trainers can, as expediently as possible, explain the procedure and review the teacher guide and the student materials. In practice, teachers often volunteer for personal reasons such as improving their future career prospects. Positive enthusiasm for the project must be bought with time spent explaining and illustrating the planned development of the program and the teacher's valuable part in it.

Boy and Girl Scouts, Red Cross/Crescent, Hospital Grey Ladies, and Rotarians are all volunteers of one sort or another. All of these organizations have learned that their volunteers must be oriented or trained, and continually nurtured. Nurturing involves receiving feedback as well as giving advice and assistance. Nurturing can also involve the organization of a support network, including local or regional groups, that would periodically bring together teachers, school principals, and district supervisors to discuss both good practices and inherent problems. On a biannual or annual basis, trainers and supervisors from the regional or national IRI unit might meet with local or regional groups to provide refresher training, training for newly appointed teachers, or to participate in a discussion of problems. Best practices from one group can be passed on to others. Furthermore, exchanges can be encouraged among the various local and regional groups.

Nurturing can also involve the preparation and distribution of newsletters, radio programs directed exclusively to the teacher, and updates to the teacher guides. Provision for this nurturing should be part of the initial project design and budget. Teachers, school principals, and district supervisors can be encouraged to share innovations that they may have devised, such as songs, games, and any other novel methods of reinforcing the programs' content.

The appointment of special IRI supervisors can be prohibitively expensive. The culture of school supervision has, thankfully, been changing in recent years from an "inspecting" to a "guiding, helping, and nurturing" role. However, supervisors are rarely eager to take on additional responsibilities. Like teachers and school directors, supervisors must be carefully invited to buy into the IRI program. If regular supervisors are convinced and concerned, if they regularly visit schools and classrooms, and if they receive training and nurturing themselves, then they can also provide nurturing supervision to IRI teachers.

The entire training and supervision system itself can be organized along similar lines. Once

the IRI program has been developed, piloted, and proven, and moves into the sustainability phase, the training unit or department will become more prominent. In a small country, close contact may easily be maintained with classroom teachers, but in larger countries it will be necessary to create a network as described above. The central office trainers become trainers of trainers, promoter-nourishers, organizers of radio magazine programs for teachers, and writers of newsletters, bulletins, and add-ons. Former scriptwriters may have their position descriptions modified to become trainers or writers of other types of "promotional" materials.

Evaluation. MOEs, for a variety of reasons, do not like to invest their own money (including loan funds) in research and evaluation, principally because by definition, the results are unpredictable and the political benefits are not assured. While grudging recognition may be awarded to the role of formative evaluation in the development of program materials, it is necessary to convince ministries that periodic evaluation of IRI programs to assess effectiveness and obtain feedback from all participants makes sound political and financial sense. The constituency needs to know how things are going—if, for example, children are indeed learning better than those not participating in an IRI program; if teachers and school principals are satisfied; if teachers and children are doing what they are supposed to be doing in the IRI classroom; and if the materials are still pertinent and in acceptable condition. Soliciting feedback from participants and parents builds their sense of ownership and commitment to the program. With this perspective, evaluation, monitoring feedback, and research are clearly integral components of the drive for sustainability.

Long range planning and budgeting. As mentioned in the discussion on management, a long range planning and budgeting tool should be developed from the beginning of the IRI project. Irrespective of commitments ensconced within a donor or loan agreement for completion of certain activities within a given period, a long range prognostic is an essential first step in achieving sustainability.

Attendance to the presence or absence of these factors may not guarantee a successful or long lived IRI project, and in fact several of the projects we have described did pay attention to these factors in varying degrees. But in developing fresh IRI initiatives, prospects for sustainability will certainly be enhanced by seeking vigorous local

leadership, securing long term financial commitment, marketing the project in the political and social arenas, building commitment and ownership among participants, working for integration into the education system, and regularly re-activating teachers and their supervisors.

7. A PARADIGM SHIFT IN THE DELIVERY OF EDUCATION

BY ALAN DOCK

DOES IRI HAVE A FUTURE?

Education has reached a watershed. Computers and the Internet promise to make learning accessible in a multitude of formats to anyone anywhere in the world. A nineteenth-century distance learning course for the “ordinary man”¹ had 500 pages of close print occasionally mitigated by a small line drawing. Modern media packages for distance learning incorporate print, color pictures, audio and video images, and are designed to be interactive with the learner. Access to this form of distance learning is already available globally where the connective technology exists—and the degree of connectivity is rising exponentially. We believe very strongly that IRI has a future in this evolving scenario.

The preceding chapters have described some of the breadth of IRI experience, its strengths and weaknesses, its likely costs, and what is needed to ensure sustainability. IRI is not merely a low cost, stopgap measure for financially strapped countries, nor is it solely for countries with a limited pool of trained teachers. Evaluation in many countries and contexts has shown that significant learning gains can be achieved through IRI, meriting its inclusion as one of a compendium of tools for *any* classroom.

In countries where teachers are unqualified, IRI provides a rich teaching medium that not only reaches large numbers of students, but also indirectly affects the classroom teacher and stimulates improvements in the teaching of other classes when IRI is not present. This aspect of IRI is exciting, because it promises at least part of the solution to the problem of improving teacher quality.

In an increasing number of countries, children are exposed to the rapid-fire approach of commercial radio and television, and the teacher is challenged to make the classroom learning environment



Andrea Bosch

just as lively, exciting, and flexible through his/her own delivery methods. The classroom environment is being transformed from a teacher-centered information source to a mosaic of sources, each appropriate to a particular learning context. Carefully designed IRI programs can form an important part of this mosaic.

Most educational radio programs fail for two main reasons. First, to appeal to a large audience, program content tends to be broad and not closely linked to specific curriculum objectives. Second, individual teachers and classes move at different paces through the curriculum, and the content of the radio program is often not appropriate for a particular classroom. An IRI lesson sequence, on the other hand, *governs* to a large extent the pace of the learning process in the classroom through its design, thus ensuring that all the classes it reaches are in lockstep.

The growth of computer-based learning is not limited to the field of distance learning. Many countries are experimenting with this technology in the classroom. It is already clear that the technology will provide a powerful learning tool, but it need not supplant other forms of reaching students, such as IRI. Multimedia computer-based learning programs, delivered from a storage device or via the Internet, focus on individual or small-group learners due to the high cost of terminals, software, etc. IRI, however, is essentially a large-group tool. Class group teaching has an intrinsic merit—it helps create a web of understanding and provides group support as individuals advance their own learning. For these reasons and the others stated above, IRI will continue to be a valuable option for educational planners.

NONFORMAL EDUCATION

The rapid change in how education is delivered has been accompanied by a realization that providing a full and complete education system for all children and adults through the use of traditional methods is beyond the reach of many countries. While print technology has enabled major advances in education, electronic media in some form also have much potential to bring education to all. Computer-based learning will assuredly provide part of the solution, but radio and IRI will also make significant contributions.

There is much anecdotal evidence that IRI has a beneficial effect on “shadow learners,” i.e., casual listeners. Not so well documented is the effectiveness of broadcast radio in reaching a mass audience through the ubiquitous “soap opera.” The soap opera, or serial play, is generally scripted around characters and situations with which the audience easily identifies, resulting in enormous and sustained popularity. Some programs, e.g., the BBC’s *Archers*, have been running for decades and create such a strong illusion of reality in the audience that crises affecting the characters and their lives provoke widespread comment and discussion. Educational messages subtly woven into the script of such productions could have very powerful effects on attitudes and behaviors in their au-

diences. Elsewhere in this study we have described the successful use of IRI to educate child caregivers and to modify teacher behavior as examples of the efficacy of IRI in the adult learning realm. A marriage between the soap opera and an IRI followup program could prove to be a powerful combination in tackling the need for a wide spectrum of administrative, managerial, and social skill enhancement packages.

RADIO OR TELEVISION?

A strong competitor for the broadcast media slot in the educational compendium is television. Many attempts have been made to harness the visual images of television to the educational wheel, and many have failed. One early lesson learned, for example, was that learners have difficulty concentrating on a single image for any length of time, i.e., “talking heads” are ineffective teaching tools. The opposite extreme of a constantly changing picture with attention-grabbing visual effects is equally ineffective—the learner tends to adopt a passive and relaxed mode of viewing; the images wash over the learner like a pleasant shower. Producers have learned to maintain a strong central theme and reduce the effects to a level that maintains focus without numbing the intellect. *Sesame Street* (United States), and *Tele-Tubbyland* (United Kingdom) are examples of children’s educational programs that maintain a central storyline around which lessons are woven.

In a sense, the lack of visual presentation is one of the strengths of IRI—its absence encourages cognitive abstraction of concepts and their internalization. Thus, IRI is much more interactive than most television programs, and it is compatible with the constructivist learning theories.

In developing countries, television transmission is usually confined to main urban centers, and therefore national coverage is expensive (though this may change as satellite transmission and reception of TV signals becomes more common). Radio transmission is widespread in most countries, relatively cheap, and recognized by the general population as a source of information,

education, and entertainment. Here too, technology is rapidly changing the quality of reception and access (see below). TV receivers are complex, delicate, expensive, and require high-level skills to maintain and repair. Radio receivers are technically robust, low cost, and easily maintained. The energy requirement for a TV receiver is 10 to 100 times that of a radio and therefore cannot easily be supplied by alternative energy sources. Energy for a radio can be supplied from many sources other than a national power supply.

In short, the question raised at the beginning of this section is not answered by an either-or solution. All media have strengths, but in terms of availability, cost, and documented effectiveness, radio has the edge for many countries struggling to improve the quality of their education systems.

RADIO DELIVERY SYSTEMS

The proliferation of FM radio transmission over the past two decades has revolutionized listeners' perception of quality reception. The older AM format—either on medium or short wave—had a propensity for fading, a vulnerability to static interference from storms or electrical equipment, and a limited audio frequency range. FM reception is invariably unfading, impervious to sources of electrical interference, and delivers a full range of audio frequencies, often in stereo mode. Because FM transmissions are confined to line of sight, transmitters need not be very powerful, and their relatively low cost in comparison to the old heavy-power AM transmitters means that a network of repeater stations is economically feasible to overcome their limited range. Most successful IRI programs have utilized an FM system.

An additional advantage of a national FM network is that it can be deliberately fragmented for specific purposes, such as the local broadcast of lessons appropriate only to particular areas.

A recent development in the FM category is the “transmitter in a briefcase.” Developed for remote communities of Canada, the system—which has a range of approximately six miles and

costs less than US\$5,000—is being used increasingly as the basis for community radio in other parts of the world.¹ Schools in Canada have been quick to make use of the system, and the use of audiocassettes and CDs would enable the system to be used for local broadcast of IRI programs.

A newcomer to the mass communication scene, but one with a lot of potential, is direct satellite broadcast. This technology is likely to have a profound impact on education over the next decade. Satellite broadcasts have advantages similar in quality to FM radio, with the added advantage of wide geographical coverage. For example, the reach of a high-orbit geostationary satellite can be as wide as the entire continent of Africa. Low orbiting satellites have more limited ranges, but they are still much greater than the conventional FM transmitters. The disadvantages of satellite systems are their high cost and the sophisticated technology required to receive their signals. However, it can be anticipated that the costs for receivers will fall dramatically, just as they have for FM receivers. Until prices fall to acceptable levels, however, a hybrid system is probably the best strategy if access to these global channels is desired.

All of the above systems of radio reception depend on a reliable source of electrical energy. While most towns can plug their receivers into the wall and tap the national or regional electricity system, the majority of rural communities do not enjoy that luxury. For them, the alternative has been to use nonrechargeable batteries. In many communities this imposes an unacceptable financial cost on radio reception, thus limiting its use.

IRI systems that depend on battery-powered reception often report only intermittent reception of lessons. As mentioned above, radio receivers are now on the market that use solar batteries or

¹For further details on the transmitter in a suitcase, consult Commonwealth of Learning Web site at www.col.org/models/nonform.htm#radio. For further details on the use of the technology in Canada, contact World Association of Community Radio Broadcasters (AMARC), Head Office 3575 Boulevard St-Laurent, Suite 704, Montreal, Quebec, Canada H2X 2T7. Fax 514-849-7129.

clockwork-driven internal generators, both of which greatly reduce the recurrent costs of maintaining radio reception.

GLOBALIZATION OF IRI

In the previous section, technologies were described that are making possible good-quality global reception. For IRI (and other educational programming), this raises serious issues of universality. Part of the success story of IRI lies in the manner in which it has spread around the globe. In many instances, the seed for a new project has been an agreement between governments making materials and expertise from one country available as the startup capital in another. In some cases, the degree of adaptation required is minimal (same language, similar cultures), but sometimes more extensive surgery is required. Yet the existence of successful program materials has always provided a powerful source of inspiration to the new developers, and in most cases the progenitor is still recognizable at the end of the process.

The new technologies of transmission and reception outlined in the previous section will encourage regionalization of programs and further stimulate the tendency to share program development costs and experiences. There is need perhaps for an organization to act as a clearinghouse for IRI. One of that entity's first tasks might be to produce generic program materials for free adaptation by any country wishing to use them. National curricula in core subjects, such as language and mathematics, are rapidly moving toward a common content, particularly at primary and adult literacy levels, making the design of such program packages definitely feasible. Generic prototype series, created with specific subject areas and targeted to particular age groups, would offer significant savings over the cost of developing the same material from the ground up. They would also have the merit of providing tested and evaluated material. Generic prototypes could indicate successful formats, plot outlines, and potential characters, leaving plenty of room for local cultural adaptation. Using a generic core would allow national identity to play its role in the

adaptation processes. In addition, it would enable the training of local capacity for further development and maintenance of the system.

SUMMARY

- Evaluation of many countries and contexts has shown that significant learning gains can be achieved through IRI, meriting its inclusion as one of a compendium of tools for *any* classroom.
- For most countries, providing a full and complete education system for all children and adults through the use of traditional methods is beyond the scope of foreseeable resources.
- Both television and radio have their strengths, but in terms of availability, cost, and well documented effectiveness, radio has an edge.
- Direct satellite broadcast is the technology likely to have the most profound impact on education over the next decade.
- Radio receivers are now on the market that can greatly reduce the recurrent energy costs of maintaining radio reception.
- There is need for an organization to emerge that could serve as a clearinghouse. One of that entity's first tasks might be to produce generic program materials for free adaptation by any country wishing to use them.

IRI has come of age. Its substantial research base has enhanced understanding of its strengths, given warnings of its weaknesses, and signposted strategies to counter them. Educational planners should be confident that when they include IRI as one facet of their educational development strategies, they are using a tool that has been sharpened on the grindstone of experience. The globalization that is upon us as a result of rapidly improving electronic communications can be perceived as a means of tapping that experience—a source of raw material to be selected and adapted to meet local needs. We hope this study has revealed some of this experience.

ANNEX: ANNUALIZING INVESTMENT COSTS

1. The need to annualize investment costs

Because most cost analyses are done for periods of a year or less, a special problem arises with the costs of long lived assets, such as facilities, equipment, radio lessons, and upfront training, where the expenditures are made in one period but the benefits are reaped over a number of years. This appendix describes the conventional method of allocating investment or “capital” costs on an annual basis. The costs of long lived assets are generally of two types: depreciation and the financial cost of capital.

2. Depreciation

Depreciation is the portion of the value of the capital good that is consumed in any one period, either through wear and tear or through obsolescence. Depending on the purpose, annual depreciation can be measured in different ways. For example, it can be measured as the decrease in value in a given calendar or project year, the average annual decrease in value over several calendar or project years, or, finally, according to a formula that allocates the decrease in value over the lifetime of the asset.

3. The financial cost of capital

The second capital cost that must be considered is the financial cost of capital, which is simply the cost of tying up resources in a particular capital good that could have been used for other expenditures. This cost is measured by the appropriate interest or “discount” rate for the entity bearing the cost. If the entity bearing the cost is “society,” the appropriate discount rate is the “social discount rate,”¹ i.e., one that reflects the value

¹Levin (1975), Jamison, Klees, and Wells (1978,) and Glick (unpublished) provide further discussion on annualizing capital costs.

society would have gained by using the financial resources for current consumption rather than tying them up in a piece of equipment or another long lived asset with the purpose of producing consumption in future years. Since “society” cannot be interviewed directly, what society pays for capital, as measured by inflation-adjusted interest rates prevailing in private financial markets (when they are deemed to be functioning adequately), is the measure typically used to approximate the social discount rate. If the entity bearing the cost is the national government or a particular local government, the inflation-adjusted interest rate at which that government borrows can be considered its financial cost of capital.

4. Selecting the appropriate discount rate

Selecting the appropriate discount rate for a social investment project is, thus, somewhat tricky, and different analysts come up with different answers. To maintain consistency across different analyses, therefore, discount rates have become conventionalized in different contexts. Organizations often prescribe the particular discount rate that is to be used for projects under their jurisdiction. Alternatively, the analyst can use a range of discount rates to determine the sensitivity of total project cost to variation in the discount rate. In any case, analysts and users of their analyses need to understand that the “cost of money” is just as real a cost as the cost of teachers’ salaries or supplies and cannot be neglected without biasing the analysis in favor of capital-intensive interventions.

5. Calculating annualized investment cost

Investment cost for a given year is the sum of the depreciation and the cost of money for that year. If one is willing to model depreciation in a particular way (to be described), which is adequate in most circumstances, there is a conventional al-

Table A-1: Annualized capital cost and components

	Year of life^a (1)	End of year annualized cost^b (2)	Depreciation component^c (3)	Cost of capital component (4)
Years of useful life	1	\$28,117	\$13,117	\$15,000
	2	\$28,117	\$14,428	\$13,688
8	3	\$28,117	\$15,871	\$12,246
	4	\$28,117	\$17,458	\$10,658
Cost of equipment	5	\$28,117	\$19,204	\$8,913
	6	\$28,117	\$21,124	\$6,992
\$150,000	7	\$28,117	\$23,237	\$4,880
	8	\$28,117	\$25,561	\$2,556
Discount rate				
10%	Total	\$224,933	\$150,000	\$74,933
^a The year of life is denoted PER in the Excel spreadsheet function.				
^b The Excel spreadsheet function is PMT(10%,8,150000). The Lotus 123 function is similar.				
^c The Excel spreadsheet function is PPMT(10%,PER,8,150000). The Lotus 123 function is similar.				

gorithm that easily calculates a constant annualized investment cost.² It is mathematically equal to equal annual payments on an equipment loan, a widely familiar concept and one that can be easily calculated in any computer spreadsheet program. Using this algorithm, the depreciation is set equal to the principal portion of the payment, and the cost of capital is set equal to the interest portion of the payment. In this calculation, depreciation starts out small in the early part of the investment's life and increases at the end. Table A-1 gives an example of a \$150,000 capital good with a life of eight years and calculates the annualized capital cost using the PMT function of the Excel spreadsheet. In this example, with a 10 percent discount rate, the annualized capital cost is \$28,117. Depreciation would rise from \$13,117 in Year 1 to \$25,561 in Year 8. The cost of capital would start at \$15,000 in Year 1 and decline to \$2,556 in Year 8 in line with the remaining value of the asset.

6. Useful equipment life

Different useful equipment lives would result in different annualized capital costs (Table A-2). Notice that the entry under 8 years of useful life is the same as in Table A-1, column 2.

²Annualized investment cost = investment cost $\times \left(\frac{i}{1 - (1+i)^{-n}} \right)$, where i = the opportunity cost of finance and n = the number of years of useful life.

ANNUALIZING INVESTMENT COSTS

Table A-2: Annualized capital cost

	Years of useful life^a	End of year annualized cost^b	Annualization factor^c
	(1)	(2)	(3)
Cost of equipment	1	165,000	1.100
\$150,000	2	86,429	0.576
	3	60,317	0.402
Discount rate	4	47,321	0.315
10%	5	39,570	0.264
	6	34,441	0.230
	7	30,811	0.205
	8	28,117	0.187
	9	26,046	0.174
	10	24,412	0.163

^aNumber of years=NPER in the Excel spreadsheet function, see note 2.

^bThe Excel spreadsheet function is PMT(10%,NPER,150000). The Lotus 123 function is similar.

^cCalculated by dividing column 2 by the cost of the equipment.



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